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Economic Determinants of Rural-Urban Labor Migration: The Case of Korea

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ECONOMIC DETERMINANTS OF RURAL-URBAN LABOR MIGRATION: THE CASE OF KOREA

by

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Hong Youl Park

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Economic Determinants of Rural-urban Labor Migration:

The Case of Korea

by

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Though it is conceded that the major stream of migration in developing countries flows from rural to urban areas, research on identifying the principle determinants of rural-urban migration are quite scarce. This is especially so in quantitative terms. Therefore, hypotheses concerning the economic determinants of rural-urban migration are investigated and economic impact of rural-urban migration is also examined in this dissertation.

Migration can be viewed from many different perspectives -- selectivities, pull and push, human investment approaches, etc. However, this study follows economic tradition and views migration in a general equilibrium context. In the economic opportunity hypothesis, discrepancies of factor payments among regions is postulated. The significance of selected economic determinants such as the magnitude of capital investment and relative prices of rural and urban goods is then tested along with the economic opportunity hypothesis.

The migration model in this study is specified as a system of interrelated equations. The simultaneous equations model which

is employed, enables us to examine the effectiveness of key variables on migration, and the impacts of these variables on rural and urban labor markets. The model is tested with Korean labor force data.

Rural wage rates were found to have a negative relationship with migration, whereas urban wage rates showed a positive relationship. The changes in relative prices of rural and urban goods were found to exert a significant impact on rural-urban migration. A decrease in prices of rural goods may induce an increase in out-migration and an increase in prices of urban goods may be a pulling factor of rural-urban migration such that rural-urban migration increases. Thus, the net out-migration may be reduced when agricultural prices increase.

An increase in capital investment in rural areas was found to reduce rural-urban migration, and an increase in capital investment in urban areas was found to encourage rural-urban migration. Investment was found to be the most significant variable in determining wage rates, however, it was less significant than the prices of rural and urban goods in determining rural-urban migration.

It is concluded that changing relative economic opportunities, changing output prices, and capital investments between rural and urban areas are important factors providing impetus for rural-urban migration and they are major economic determinants of rural-urban migration in Korea. Thus, government is faced with alternative policies for the reduction of rural-urban migration. For instance, the government may give wage subsidies to the rural employment sector, it may increase large-scale public investments, or it may allow a rise in agricultural prices. Each of these policies would tend to reduce the

flow of resources from the agricultural sector to non-agricultural sector.

A redistribution of resources may not facilitate efficient resource allocation and the optimal growth of the national economy. Therefore, the efficiency aspects of stimulating a resource flow should be examined carefully before these policy variables are implemented for achieving population redistribution.

(120 pages)

CHAPTER I

INTRODUCTION

Most recent studies of migration in developing countries indicate that the major currents of migration are funnelled into the urban areas.[1] Korea has also experienced a significant urban concentration in recent decades. About 40 percent of the population is now in agriculture, compared to about 70 percent twenty years ago. The agricultural population has been decreasing not only relatively but in absolute terms as well--an obvious reflection of Korea's transition from an agriculture to an industrial economy.

Although there was a continuous net movement of peoples from rural to urban areas in western nations while they were pursuing industrialization about two centuries ago, the problems associated with urbanization were less apparent in these countries. The rate at which the urbanization proceeded was low by modern standards and industrialization proceeded hand in hand with the urbanization. In contrast, in the developing countries today the problem of urbanization is more significant not only because urbanization is taking place at a far faster rate, but also industrialization often lags behind the urbanization. Although rural-urban migration is regarded as a necessary concomitant of industrialization and modernization, rapid urban concentration is worrisome to many governments and it poses a very serious problem in Asia. The urban concentration in Korea has been regarded as one of the major

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[1] Greenwood's study on India and Egypt, T.P. Schultz's study on Columbia, Beal's and others' study on Ghana, Sahota's study on Brazil, and Herrick's study on Chile all agreed upon the urban concentration of migration.

concerns of the government because migration from rural to urban areas depletes the traditionally labor intensive of their workers despite the fact that Korean agriculture has been largely labor intensive with a low rate of technical progress. The sharp increase in food imports and agricultural wages and the slowing of the economy, which are related to the urban concentration of population have become the major political and economic issues of the country. Continuous out-migration from the farm sector could reduce agricultural production and more specifically, the food supply. The major urban centers are experiencing problems commonly associated with cities which have grown rapidly, including scarcities of urban housing, transportation, and water supplies, and environmental concerns.

Realizing that problems associated with rapid urbanization resulted from the emphasis on industrialization in Korea's first and second five-year economic plan, the Korean government shifted the major emphasis of the Third Five-Year Economic Plan (1972-1976) to seek a balanced economy and ensure balanced regional development.[2] The current plan proposes a four-fold increase in agricultural investment over the previous plan. This change of policy implicitly presumes that the emphasis on industrialization was a contributing factor in the redistribution of the population between rural and urban areas.

Though considerable research has been devoted to identifying the principal determinants of rural-urban migration and its impact upon labor markets, empirical studies which focus on the determinants of

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[2]Government of Republic of Korea, The Third Five-Year Economic Development Plan (1972-1976), 1971, p.1.

migration are quite scarce, and especially so in quantitative terms. Therefore, this study will examine the significance of selected economic determinants of rural-urban migration such as the magnitude of capital investment and relative prices of rural and urban goods on rural-urban migration in quantitative terms and will also examine the impact of these variables on labor markets.

Migration can be viewed from many different perspectives--selectivities, pull and push, human investment approaches, etc. However, this study will follow economic tradition and view migration in a general equilibrium context. The economic opportunity hypothesis in which discrepancies of factor payments among regions are the major causes of factor mobility is postulated. Some of the important questions which will be answered are: What are the economic and social consequences of rural-urban migration? Is the urban wage rate falling and rural wage rate rising with a consequence of labor shifting from rural to urban areas? Is the labor shift due to increasing pressure on the land in rural areas? These crucial questions associated with rural-urban migration need to be examined as a means of assuring efficient allocation of labor resources between the two sectors.

The Objectives

The general objective of the present study is to relate economic variables to demographic variables in a causal way. The specific objectives are:

1. to estimate the size of net rural-urban migration from 1955 to 1972;
2. to build a migration model in order to identify and test major economic determinants of rural-urban migration; and to examine the economic impacts of these variables

on rural-urban migration and on the rural and urban sectors of the economy.

The census data necessary for estimating the net annual labor migration are available for four years (1955, 1960, 1966, and 1970). These four observations, however, are not sufficient to yield any statistical significance. Since there are no official annual migration data, the net labor migration data were obtained from the labor force statistics.[3]

The second objective is to build an analytical economic model to identify the major economic determinants of rural-urban migration and to examine the economic impacts of these variables on the rural and urban sectors of the economy. The first part of the second objective is concerned with the formulation of the testable hypothesis into an analytical, economic model. The model is to identify economic variables which have important causal links on migration at the macro level. Migration is hypothesized to be at least partially a labor factor adjustment resulting from discrepancies of factor payments between regions. The major economic determinants will be the variables which affect factor payments.

Another aspect of the second objective is to examine through the utilization of the model the impacts of migration on the rural and urban sectors. There are two usual ways in which economic models are employed: in analysis and forecasting. In analysis the model helps to check the consistency of the various assumptions made. The effects

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[3]Economic Planning Board, Republic of Korea, Statistical Year Book (Seoul, Korea: Economic Planning Board, 1957-1973).

of a change in the definitions and assumptions can be studied in detail. The analytical model should serve to isolate a few key variables that are crucial in the study for more intensive scrutiny. The complete migration model should facilitate prediction concerning the probable effects of change in the economic variables. Traditional migration models mainly concentrate on the wage differential between regions in a single equation framework. However, the migration model in this study is specified as a system of interrelated equations. The simulataneous equations model which is employed will enable us to examine the questions of population redistribution and the effectiveness of key variables on migration and the impacts of these variables on rural and urban labor markets.

A discussion of the research focusing on these objectives is entertained in Chapters II - IV. Chapter II contains a review of migration theory which provides the basis for subsequent development of the migration model. Chapter III outlines the basic framework for analysis, relating migration to public policy variables, and records testable hypotheses concerning key economic and demographic variables. Chapter V overviews the study and provides concluding discussions with respect to the utility of the information developed in the study.

The Scope of the Study

Rapid industrialization and the change of demographic conditions in rural areas may facilitate rural-urban migration. An increase in investment in urban areas and lower prices of agricultural products are common phenomena when a country is pursuing rapid industrialization. The magnitude of investment and the changes in relative prices exert

impacts on the redistribution of labor between rural and urban sectors of the economy. The import of modern medical technology from the modern sector to the rural sector results in a demographic transition from a high birth rate and high mortality rate to a high birth rate and a low motality rate. This demographic transition in the rural sector brings rapid natural increase in the rural population; it is known as the push factor of rural-urban migration in migration studies. Therefore, the magnitude of investment, the changes of the relative prices and the fast natural increase in population in rural areas may be the most important variables for rural-urban migration. However, most migration studies do not consider these variables. This study will specifically address itself to the impacts of these variables on rural-urban migration and to the economic impacts of these variables on the rural and urban economies.

The concept of impact will be treated within the framework of the economic model. Instead of using the traditional single equation model, a simultaneous equations model will be proposed. The magnitude of investment and the changes in relative prices will be policy variables in this system. If they exercise a strong explanatory power, then the conclusion can be drawn that these variables will alter the allocation of labor resource and will induce the change of production.

CHAPTER II

REVIEW OF THE LITERATURE

There are many hypotheses or theories purporting to explain migration. This review will be limited to the major streams of development of the law of migration. It will provide the foundation for the migration model, especially the migration equation in the simultaneous equations model. The discussion is divided into four major sections: (1) pull and push theory of migration; (2) human investment model; (3) selectivity hypothesis; (4) rural-urban migration. The first section consists of three minor subsections; (i) population and distance, (ii) economic opportunities, (iii) migration, distance and economic opportunities.

Pull and Push Theory

One explanation of internal migration comes from the late nineteenth and twentieth century English economists, notably Ravenstein (1885, 1889) and Redford (1926).[4] The forces that determine migration were called "the law of migration" by Ravenstein. He explained the laws of migration in the following way:

> It does not admit of doubt that the call for labor in our centers of industry and commerce is the prime cause of those currents of migration which it is the object of this paper to trace. If, therefore, we speak perhaps somewhat presumptuously of "laws of migration," we

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[4]E.G. Ravenstein, "The Laws of Migration," Journal of Royal Statistical Society, Vol. XLVIII, No. 2 (June 1885), pp. 167-227. Arthur Redford, Labor Migration in England, 1800-1850 (Manchester University Press, 1926).

> can only refer to the mode in which the deficiency of hands in one part of the country is supplied from other parts where population is redundant.[5]

In substance, this statement identifies the demand side of labor as the pull factors from destination areas. In addition to the general explanation of the laws of migration, Ravenstein itemized the explanation in detail. Ravenstein's laws of migration have been summarized in his own words with proper headings by Everett S. Lee.

1. Migration and distance - (a) "The great body of our migrants only proceed a short distance and migrants enumerated in a certain center of commerce and industry." (b) "Migrants proceeding long distances generally go by preference to one of the great centers of commerce and industry."

2. Migration by stages - (a) "There takes place consequently a universal shifting or displacement of population, which produces 'currents of migration,' setting in the direction of the great centers of commerce and industry which absorb the migrants." (b) "The inhabitants of the country immediately surrounding a town of rapid growth flock into it; the gaps thus left in the rural population are filled up by migrants from more remote districts, until the attractive force of one of our rapidly growing cities makes its influence felt, step by step, to the most remote corner of the kingdom." (c) "The process of dispersion is the inverse of that of absorption, and exhibits similar features."

3. Stream and counter stream - "Each main current of migration produces a compensating counter stream." In the modern terminology, stream and counter stream have been substituted for Ravenstein's current and counter-current.

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[5]E.G. Ravenstein, ibid., p. 198.

4. Urban-rural differences in propensity to migrate. - "The natives of town are less migratory than those of the rural parts of the county."

5. Predominance of females among short distance migrants. - "Females appear to predominate among short-journey migrants."

6. Technology and migration. - "Does migration increase? I believe so!... Whenever I was able to make a comparison I found that an increase in the means of locomotion and a development of manufacturers and commerce have led to an increase of migration."

7. Dominance of the economic motive. - "Bad or oppressive laws, heavy taxation, an unattractive climate, uncongenial social surroundings, and even compulsion (slave trade, transportation), all have produced and still are producing currents of migration, but none of these currents compare in volume with that which arises from the desire inherent in most men to 'better' themselves in material respects."[6]

Here Everett Lee did not talk about one factor which is important in the development of migration theory.

8. Sizes of population. - "In forming an estimate of this displacement we must take into account the number of natives of each country which furnishes the migrants, as also the population of the towns or districts which absorb them."[7]

The key points of Ravenstein's laws of migration may be expressed in the following mathematical form:

$$M_{ij} = f(P_i, P_j, E_j, D_{ij}) \qquad (1)$$

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[6]Everett S. Lee, "A Theory of Migration," Demography, Vol. 3 No. 1 (1966), p. 48.

[7]E.G. Ravenstein, ibid., p. 198.

where M_{ij} represents the number of migrants from origin i to destination j, P_i, P_j are populations at origin and destination respectively, E_j denotes the opportunities at destination, and D_{ij} is the distance from i to j. This mathematical form includes primarily items 1, 7, and 8 of the above laws of migration. Items 2, 3, 5, and 6 are related to the characteristics of migrants which are accorded greater emphasis in another migration theory called the selectivity hypothesis.

First, we are going to trace the development of the laws of migration shown above in functional form. Redford put stress on the supply side of labor which may be called the 'push factors' of migration. People are pushed out from rural areas by factors such as an outmoded land-tenure system, unfavorable terms of trade, wide dispersion of property and income pressure of rural poverty in general, and so on. Ravenstein and Redford's laws of migration that may be called a 'pull and push' theory of migration can be written as follows:

$$M_{ij} = f(P_i, P_j, E_i, D_{ij}) \qquad (2)$$

where E_i denotes opportunity at origin i. This mathematical form suggests that the volume of migration depends on the size of population at i and j, opportunities at both regions and the difficulties of the journey itself.

Since the laws of migration were set forth many social scientists have attempted to empiricize the relationship between the volume of migration and the variables identified in the laws. The historical development of these efforts will be reviewed with special references to the selection of variables.

Population and distance

One of the earliest studies conducted by Stouffer is the intervening opportunities hypothesis.

> The theory here proposed and studied empirically assumes that there is no necessary relation between mobility and distance moved. Instead, it introduces the concept of intervening opportunities. It proposes that the number of persons going a given distance is directly proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities. Another way of stating the same hypothesis is that the number of persons going a given distance is directly proportional to the percentage increase in opportunities at that distance.[8]

Stouffer proposed the operational mathematical form of his hypothesis.

$$\frac{\Delta Y}{\Delta S} = \frac{a\Delta Y}{X\Delta S} \qquad (3)$$

where ΔY represents the number of persons moving from an origin to a circular width ΔS, its inner boundary being $S - \frac{1}{2}\Delta S$ units of distance from the origin or center of the circle and its outer boundary being $S + \frac{1}{2}\Delta S$ units from the origin. X represents the number of intervening opportunities, that is, the accumulated number of opportunities between the origin and distance S. Thus, ΔX represents the number of opportunities within a band of width ΔS.

The idea in Stouffer's model is that the number of people going a given distance S from a point is not a function of distance directly but rather a function of the spatial distribution of opportunities.

The model in this original paper was inadequate in handling marked

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[8]Samuel A. Stouffer, "Intervening Opportunities: A Theory Relating Mobility and Distance," American Sociological Review, Vol. 5, No. 6, (December 1940), p. 846.

directional drifts where the uneven distribution of opportunities within the circle might facilitate greater movement in one direction from the starting point than in an opposite direction. Later he published an article to strengthen the argument.[9] He proposed that the distance might be measured not in miles but in terms of economic distance, based on transport costs.

Another study explaining distance was done by Zipf.[10] He showed that the number of persons that move between any two communities in the United States whose respective population are P_1 and P_2 and which are separated by the shortest transportation distance, D, will be directly proportional to the product, $P_1 \times P_2$, and inversely proportional to distance, D. This is the so called "gravity hypothesis" in migration studies.

Dodd defined interactance and tested the interactance hypothesis.[11]

$$I_e = \frac{k\, I_A P_A I_B P_B T}{L^{-1}} = \text{the interactance defined} \quad (4)$$

where T = the total time of interacting,

L^{-1} = the inverse of the distance between two groups, where the exponent 1 (the small letter L), in amount, weights its base factor,

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[9] _____, "Intervening Opportunities and Competing Migration," Journal of Regional Science, Vol. No. 1 (Spring 1960), pp. 1-26.

[10] George Kingsley Zipf, "The $\frac{P_1 P_2}{}$ hypothesis: On the Intercity Movement of Persons," American Sociological Review, Vol. 11 (1946), pp. 677-687.

[11] Stuart C. Dodd, "The Interactance Hypothesis: A Gravity Model Fitting Physical Masses and Human Groups," American Sociological Review, Vol. 15, No. 2, (April 1950), pp. 245-256.

P_A, P_B = the population of any two groups, A and B,

I_A, I_B = the "specific indices of level," or per capita activity, whether constants characterizing each group or subset of group in a unit period,

k = a constant for each type of interacting (in a given culture and period).

This hypothesis includes the $\frac{\text{"PP"}}{L}$ hypothesis and population potential ($P/_L$) hypothesis as special cases. They are the cases where the remaining factors are unities in effect by being controlled or neglected or irrelevant.

Here human interaction is action between people who are stimulating to each other. Its operational formula involves an algebraic matrix of the primitive dimensions in which people are multiplied by people. Dodd compares the law of gravity in physics with the gravity model in sociology and derives the indices of interactance with measurable factors.

$$M_{ij} = k\frac{P_1 P_2}{(D_{12})^a} . \qquad (5)$$

where M_{ij} denotes migration from origin i to destination j, P_1 and P_2 represent population at origin 1 and destination 2, D_{12} stands for distance from origin 1 to destination 2, and a is a variable.

Anderson, after surveying and evaluating the literature, concludes that distance should be raised to a power greater than one less than two ($1 < a < 2$), and expresses the opinion that the exponent should be a variable rather than a constant. He also concludes that distance should be given greater weight and population less weight.[12]

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[12]Theodore R. Anderson, "Intermetropolitan Migration: A Comparison of the Hypothesis of Zipf and Stouffer," American Sociological Review, 20 (June 1955), pp. 287-291.

One other aspect of distance is that moves over long distances cost more than moves over short distances. In addition, the further one moves the more likely the new area is to differ in climate or local customs from the old area. Probably more important than distance as an impediment to physical movement is distance as an impediment to the flow of information. Aba Schwartz showed that the adverse effect of distance on migration is basically a diminishing-information phenomena.[13]

The two determinants of migration, population and distance can be measured easily so that they have been discussed in the early development of migration theory. However, they are not simple in their effects. Population is an index of variety of employment opportunities, cultural facilities, social contacts, and the likelihood of resident, relatives and friends. Distance subtends the effect of costs, intervening opportunities, information, and social separation, all of which are functions of distance.

Economic opportunities

In the early discussion of migration determinants opportunities are used in wide and indefinitive terms. But economists are inclined to focus mainly on economic opportunities. There are two major hypotheses which are related to the economic opportunities. The wage differential hypothesis has received earlier attention and it has been well expressed in the following:

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[13]Aba Schwartz, "Interpreting the Effect of Distance on Migration," Journal of Political Economy, Vol. 81, No. 5 (Sept./Oct. 1973), pp. 1153-1167.

> The movement of labor from place to place is insufficient to iron out local differences in wages. But the movement does occur, and recent researches are indicating more and more clearly that differences in net economic advantages, chiefly differences in wages, are the main causes of migration.[14]

The wage differential was the major force which causes migration in this statement.

However, the labor market studies advanced the job vacancy hypothesis: that workers respond to job openings. Charles A. Myers' studies concluded as follows:

> First, it is clear that voluntary movement of worker is slight when job opportunities are few, as one might expect. Most of the mobility charted in the earlier study during 1937-1939 was forced by layoffs, and it was job oriented rather than wage oriented. The same was true of displaced textile workers in 1948-1949; they usually snapped up the first job they could find and seldom shopped around or made job and wage comparisons. Second, wage differentials between jobs become more important in explaining labor mobility when there are rapidly expanding job opportunities, as in 1940-1942.[15]

This conclusion seems to favor the job vacancy hypothesis. However, the same author later indicated that two hypotheses are a useful ally in labor market analysis.[16] Similar conclusions have been drawn by many economists. The job vacancy thesis does not appear to refute the implications of wage difference theory. They are working together. Mathematical representation of these migration variables may be written as follows:

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[14]J.R. Hicks, The Theory of Wages (London: McMillan Co., 1932), p. 76.

[15]Charles A. Myers, "Labor Mobilities in Two Communities," E. Wight Bakke and Others, ed. Labor Mobility and Economic Opportunity (Cambridge: The M.I.T. Press, 1954), pp. 74-75.

[16]_____, "Labor Market Theory and Empirical Research," John T. Dunlop,ed. The Theory of Wage Determination (London 1957),pp.317-318.

$$M_{ij} = f\left(\frac{P_i P_j}{(D_{ij})^a}, W_j - W_i, V_j\right) \qquad (6)$$

where W_j denotes wage rate at destination j, W_i denotes wage rate at origin i, V_j is a measure of job availability.

Migration, Distance, and Economic Opportunity

One of the most comprehensive models is formed in Lowry's work.[17]

$$M_{ij} = k\left(\frac{U_i}{U_j} \cdot \frac{W_j}{W_i} \cdot \frac{L_i L_j}{D_{ij}}\right) \qquad (7)$$

The symbols are defined as follows:

M_{ij} = number of migrants from place i to place j.

L_iL_j = number of persons in the labor force at i and j, respectively.

U_iU_j = unemployment as a percentage of the civilian labor force at i and j, respectively.

W_iW_j = hourly wage, in dollars, at i and j, respectively.

D_{ij} = airline distance from i to j, in miles.

This model includes most of the arguments which have been developed in earlier migration studies; job vacancy, wage differential, gravity hypothesis. The form he has chosen for the expression of comparative advantage is arbitrary.

Lowry indicated that his model has an accessible causal interpretation whose dynamic implication are broadly reasonable.

> People migrate in search of jobs from low-wage to high-wage areas, and from areas of surplus labor

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[17]Ira S. Lowry, Migration and Metropolitan Growth: Two Analytical Models (San Francisco: Chandler Publishing Company, 1966) p. 12.

> to those with labor shortages. The migrants, over time, will affect the labor market of the receiving area, and as its labor supply is augmented, its relative attractiveness is diminished, or vice versa. Assuming identical coefficients for W_i,W_j and for U_i, U_j, the equilibrium condition is one which $W_i = W_j$ and $U_i = U_j$; there remains a random exchange of migrants between the two places, whose volume depends on the size of the places and the distance between them, but whose net effect on population distribution is nil.[18]

The mathematical form and interpretation of Lowry's model are not new. But he pulled the arguments together and put it into an estimable form. The estimated coefficients of the numerators are expected to be positive and those of the denominators are expected to be negative in sign.

Andrei Rogers encountered some problems in using the Lowry model for forecasting purposes and made changes in variables.[19] But he did not add new ideas or improve the mathematical form. A further development of these variables as used in this study are discussed in the next chapter.

Human Investment Model

Larry Sjaastad[20] looked at migration primarily as a form of private, rational decision-making--as a private investment that entails costs and engenders increments to life time earnings streams. To simplify, people discount the expected earnings streams for alternative courses of action: migration or remaining put. In theory, people will

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[18]Ibid, p. 13.

[19]Andrei Rogers, Matrix Analysis of Interregional Population Growth and Distribution (Berkeley and Los Angeles: University of California Press, 1968).

[20]Larry Sjaastad, "The Costs and Returns of Human Migration," The Journal of Political Economy, Vol. LXX, No. 5, Part 2 (Oct. 1962)pp. 80-93.

move if they can increase the net present value stream (present value of expected earning stream minus present value of staging put) by an amount greater than the cost of moving.

Costs, according to Sjaastad, include direct costs of moving, earnings foregone while moving, earnings foregone while researching for employment and training for a new position. Psychic costs, such as homesickness, acclimatization strains, and so on are also counted. Returns are the expected income stream at the destination. Sjaastad's primary concern was with the efficiency of migration. He stated that his costs and returns to migration approach places migration in a resource allocation framework because it treats migration as means in promoting efficient resource allocation and because migration is an activity which requires resources.

Selectivity Hypothesis of Migration

So far, discussion has focused on the formal approaches to migration study since the laws of migration. Item five of Ravenstein's laws of migration indicates that females appear to predominate among short journey migrants. This was the one of the statements which explains the selectivity hypothesis of migration. One of the most comprehensive studies on the characteristics of migrants has been done by Dorothey S. Thomas and others.[21] They focussed their research on the migration differentials and they defined the problem of migration differentials as essentially the same as the problem of selective migration. The selective migration arguments are related to the characteristics of

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[21]Dorothy S. Thomas and others, Research Memorandum on Migration Differentials, (New York: Social Science Research Council, 1938).

migrants. The research is organized to explain the migration differentials in terms of age, sex, family status, physical health, mental health, intelligence, occupation, motivation and assimilation.

Another monumental study on selective migration is associated with the works of Simon Kuznets and others.[22] This approach delineates the relationship between internal migration and economic development in terms of the selectivity of people. The migrants come from select groups. They are the dynamic risk-taking beings who have high capacity to detach themselves from the traditional surroundings and adopt themselves to the unfamiliar environment. They are stimulated to move to centers that offer better economic opportunities. The resulting redistribution of population promote subsequent growth and induces further migration of select individuals.

One of the striking assertions was that mobility widens inequality. Myrdal asserts as follows:

> The locality and regions where economic activity is expanding will attract net immigration from other parts of the country. As migration is always selective, at least with respect to the migrant's age, this movement by itself tends to favor the rapidly growing communities and disfavor the others.[23]

On the basis of the selective migration, Myrdal proposed that migration widens regional inequality. But Okun and Richardson[24] proved that

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[22]Simon Kuznets and Dorothy Thomas, et.al. Population Redistribution and Economic Growth--United States, 1870-1950, 3 Vols. (Phil.: American Philosophical Society, 1957, 1960, 1964).

[23]G. Myrdal, Economic Theory and Under-developed Regions (London, 1957). P. 27.

[24]Bernard Okun and Richard W. Richardson, "Regional Income Inequality and Internal Population Migration," Economic Development and Cultural Change, Vol. IX, No. 2 (January 1961), pp. 128-143.

Myrdal's statement is not valid and showed that the effect on inequality depends on the direction of migration, on whether one considers the short or the long run, and on whether the country involved is advanced or underdeveloped.

In tracing the main stream of migration theory, it seems clear that differences arise mainly in emphasis and interpretation of the causes and consequences of migration.

Rural-urban Migration

Classical and neo-classical arguments

Even though Ravenstein's laws of migration indicated that the major currents of migration were directed toward the center of industry and commerce the migration theory was not specific about direction of shift. However, a group of economists who are mainly concerned about the development of less developed countries focussed their efforts on rural-urban migration.

Economic theory has been utilized by economists in trying to understand the ralationships between the agricultural sector and the urban industrial sector.[25] A primary concern of development economists was to find some mechanism to lead the dual economy to capital formation via labor reallocation between these two sectors. As described in the laws of migration the redundant labor in rural areas shifted to the urban sector. But what is "redundant" labor is hotly contested among economists. The assumptions which are utilized in the analysis

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[25]This work dates from W.A. Lewis and his successors. W.A. Lewis, "Economic Development with Unlimited Supplies of Labor," Manchester School of Economics and Social Studies, XXII (May 1954), pp. 139-191.

of this matter are different for classical and neo-classical approaches.[26] The difference between the classical and neo-classical approaches is the assumption about redundant labor in the agricultural sector. The classical economists assume that the subsistence sector is characterized by zero or near zero marginal productivity of labor and a positive institutionally determined wage rate for agricultural labor, which approximates the average productivity of labor in the subsistence sector. Under these conditions they argue that it is possible to transfer labor from the subsistence sector to the commercial-industrial sector without reducing agricultural output and without increasing the supply price of labor to the industrial sector during the early stages of development.

However, the neo-classical economists drop the assumption of zero or near zero marginal productivity of labor and an institutionally determined wage rate in the subsistence sector. Wage rates are determined in an intersector labor market even during the initial stages of development. As a result labor is never available to the industrial sector without sacrificing agricultural output, and the terms of trade move against the industrial sector continuously throughout the development process rather than after substantial development in the commercial-industrial sector.

Agricultural sector in Korea

In order to derive an appropriate theoretical model it is useful to review characteristics of the Korean economy and to relate these to economic theory. First, agricultural work is very seasonal in Korea.

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[26]Dale W. Jorgenson refers to Lewis, Fei and Ranis as classical economists, and he claims himself as neo-classical.

The labor requirement during peak times is so large that there is no underemployment problem. An underemployment problem occurs only during the off-season. It is argued that unemployment is most pronounced in February, but there is much underemployment throughout the rest of the year except in months of peak agricultural activity--June, July, and October. This seasonal unemployment[27] might be the basis of the classical arguments. A recent study on labor structure on Korean economy indicated a few striking differences between two sectors.

> (1) Whereas wage labourers account for a large proportion of the total working population in non-farm households, the labor force in farm households consists predominantly of self-employed or family workers. (2) A significantly lower proportion of the labor force consists of males and of workers in the prime age group in farm households than in non-farm households. (3) The labour participation and employment rates, as a whole, are much higher in farm households. (4) The intensity of seasonal fluctuations in the employment and participation rates is likewise markedly greater in farm households.[28]

These observations are based on the data since 1960.

As indicated above there are seasonal unemployment problems in the farm economy. Even though the seasonal unemployment exists in the farm sector it may not be characterized as the basis of the classical assumptions implied. When agricultural labor is reduced, the agricultural production is decreased. Recently the absolute numbers of agricultural

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[27]Unemployment in Korea is characterized as seasonal by Youg Sam Cho, Disguised Unemployment in Underdeveloped Areas (Berkeley: University of California Press, 1963).

[28]Kwan S. Kim, "Labour Force Structure in a Dual Economy: A Case Study of South Korea," International Labor Review, Vol. 101, No. 1 (January 1970), p. 47.

labor have been decreasing and the wage rate has been sharply increased. This shows evidence of interaction of the labor markets in the two sectors.

Secondly, Korea has introduced a large amount of capital, especially foreign capital, into the rural sector since the early stages of her development to meet growing food demands.

Evidence of labor market interactions between the two sectors and capital investment in the agricultural sector suggest that the Korean economy departs from the classical assumptions. Therefore, labor migration in Korea can be analyzed in the framework of a competitive market in which the urban and rural wage rates are endogenous variables.[29]

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[29] If we follow the classical assumptions the rural wage rate would be an exogenous variable.

Roshin Minami, "Population Migration away from Agriculture," Economic Development and Cultural Change, Vol. 15, No. 2, Part 1 (January 1967), pp. 183-201. Minami made a study on Japan and he discussed the problems.

CHAPTER III

EMPIRICAL MODEL AND METHODOLOGY

It seems clear from the survey of the literature that major variables of the migration function are economic opportunity variables. The relative wage rates in rural and urban sectors can be analyzed under the assumptions of general competitive equilibrium. The purpose of this chapter is to construct a testable hypothesis which is of interest in the study of population redistribution. This chapter is divided into four sections: (1) theoretical framework; (2) variables; (3) model; (4) data and methodology.

Theoretical Framework

The classic theory on labor mobility is based on the theory of general equilibrium and a competitive market. A fundamental proposition of general equilibrium theory and the theory of competitive markets is that discrepancies in real factor payments, caused by shifts in supply and demand schedules, will lead to an appropriate reallocation of productive factors until equilibrium is restored. Shifts in the supply and demand schedules are the major causes under this scheme.

The causes for rural-urban migration in developing countries have been discussed by social scientists. They tend to stress the push factors, especially the economic one. The conclusions of a report issued in 1960 by the International Labor Office summarizes this argument:

> In the less developed countries, however, incomes from agriculture tend to fall relative to other incomes because (a) population on the

> land increases more rapidly than food output; (b) new investment is concentrated in industrial production and urban development generally; and (c) the prices of primary products in the world markets are falling. These income depressing factors may operate singly or together.[30]

The factors indicated are mainly the shifting factors of demand and supply schedules of the labor factor. These hypotheses may be applicable in explaining the rural urban migration in Korea. At least people believe that the government's heavy investment in urban areas, the unfavorable terms of trade for agricultural products and production. pressures are the major causes of rural-urban migration. These economic activities are related to the shifts of demand and supply schedules of labor. Therefore, this study will focus on the causal impacts of these economic activities on migration.

Everett S. Lee summarized the factors which enter into the decision to migrate and the process of migration under four headings:

1. Factors associated with the area of origin.
2. Factors associated with the area of destination.
3. Intervening obstacles.
4. Personal factors.[31]

The first three of these are indicated schematically in the chart 1. +, -, and 0 represent the attracting factors, repelling factors and indifferent factors respectively.

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[30]International Labor Office, Why Labor Leaves the Land: A Comparative Study of the Movement of Labor out of Agriculture, Vol. 59 (Geneva: International Labor Office, 1960), pp. 209-210.

[31]Everett S. Lee, Ibid., p. 50.

Variables

In the previous section the analytical framework and deduced hypotheses are briefly discussed as a theoretical basis of the model. We will now define a set of variables that help us state precisely and unambiguously what we shall infer at a later stage.

The migration variable

The concepts of migrants and migration seem clearest when considered in the light of the population balancing equation:

$$P_1 = P_o + B - D + I - O \qquad (8)$$

where P_o = population at the beginning of an interval

B = the number of births in the interval

D = the number of deaths in the interval

I = the number of in-migrants in the interval

O = the number of out-migrants in the interval

P_1 = population at the close of the interval.

B - D represents the net increase in population due to the births and deaths. I - O is the social increase or decrease of population due to migration at a given place. I + O is the gross migration and I - O is the net migration. Therefore, the term net migration refers to the balance of population movements in opposing directions. With reference to a specific area, net migration is the difference between in-migration and out-migration.

Migration can be measured in several different ways:

Direct measures

(1) Place of residence at a fixed past date

(2) Duration of residence, by place of last residence

(3) Place of birth statistics (POB)

Indirect measures

(4) Survival ratio methods (SRM)

(a) Census survival ratios (SCR)

(b) Life time survival ratios (LTSR)

(5) Vital statistics method (VS)

The first three methods cannot be used in this study because labor statistics data do not include enough information. The survival ratio method (SRM) involves the use of survivorship probabilities. The basic information required is the number of persons classified by age and sex as enumerated in each area at two successive censuses and a set of survival ratios which can be applied to the population at the first census in order to derive an estimate of the number of persons expected to survive the second census. The difference between the enumerated population at the second census and the expected population is the estimate of migration. The procedure may be expressed symbolically as:

$$\text{Net } M(x) = P_{x+n,\, t+n} - S \cdot P_{x,t}$$

where M(x) represents the net migration of survivors among persons aged x + n at the first census in a given area (they will be aged x + n at second census), $P_{x,t,\, t+n}$ is the population aged x + n years in the same area at the second census separated from the first census by n years, and S is the survival ratio. According to the data sources for the survival ratio, it is referred to as the life table survival ratio (LTSR) method or census survival ratios (CSR) method.

Another indirect estimate of the volume of net migration is often obtainable by using the balancing equation and assuming that population

change unaccounted for by natural increase may be imputed to net migration, i.e., that $(P_1 - P_o) - (B - D) = I - O$.[33] This is called the vital statistics method. This method, while very useful, is severely restricted in the range and scope of information it provides concerning correlates, causes, and consequences of migration and concerning characteristics of migrants and nonmigrants. However, this method may be enough for net labor migration itself. This method was used for the present study.

On measuring migration as a component of change there is a concept of rates of migration. The rates of migration may be used as measures of mobility. Assuming that two populations are being studied, let us call them P_a and P_b, and let us call the migratory movements in each of the two directions M_{ab} and M_{ba}. The rates of the form $\frac{M_{ab}}{P_a}$ and $\frac{M_{ab}}{P_b}$ are the rates of outflow and inflow of population sizes - say, the initial P_{ao} and P_{bo} and the final P_{a1} and P_{b1} - such rates provide a complete description of the migration streams in each direction, of the total gross mobility and net mobility between two populations.

Wage rate

Internal migration may result from and influence geographical differences in the productivity of labor. The differences are usually reflected in wage differences. The wage rate, therefore, is assumed to be one of the most important economic variables influencing migration. In Figure 1 the real wage rate in urban areas is higher than the wage rate in rural areas. The incentive to move from rural to urban areas stems

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[33] Judah Matras, Population and Societies (Englewood Cliffs: Prentice-Hall, Inc., 1973), p. 361.

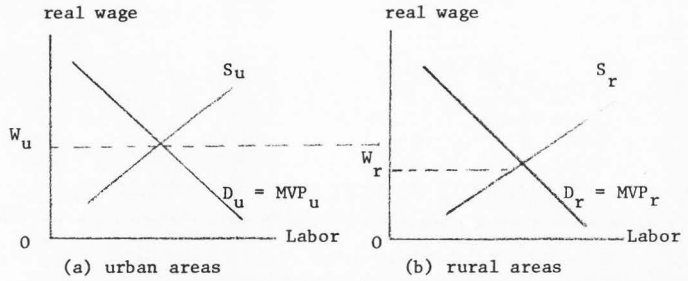

Figure 1. Wage differential between rural and urban sectors

from the fact that there is a difference in real wages which is equal to $W_u - W_r$.

Traditionally, mobility analysis has emphasized the income argument in the worker's preference function. However, rational decision making requires that workers pay attention to other utility yielding characteristics of employment - such as working conditions, climate in the area of work, quality of schools in the area, social and cultural ties, etc. Workers will respond to wage differentials only if these differentials are sufficient to overcome any non-pecuniary differences between jobs and cost of living differences.

According to the response in the decision to migrate there are several different hypotheses. Most of the early migration studies were based on the spatial economic opportunity differentials at a point in time. However, recent studies indicate that the response of potential migrants to a given wage differential may differ depending on the behavioral patterns of migrants. There are three major hypotheses on the behavioral patterns of migrants. These hypotheses assert the

proposition that a migrant takes advantage of better economic welfare conditions in another region at a given point, with a lag, or with an economic expectation.[34] Therefore, the specifications of responses on economic opportunity differentials were hypothesized in three different forms described as cases I, II and III below.

Case I. It was hypothesized that the sign and magnitude of net migration from rural to urban areas at time t is dependent upon the spatial differentials of economic opportunity at time t.

$$M_{ru,t} = m_1(W_{u,t}, W_{r,t}, E_{u,t}, E_{r,t}, L_{r,t}) \qquad (9)$$

$$\frac{\partial M_{rt,t}}{\partial W_{u,t}} > o, \quad \frac{\partial M_{ru,t}}{\partial W_{r,t}} < o$$

$$\frac{\partial M_{ru,t}}{\partial E_{u,t}} < o, \quad \frac{\partial M_{ru,t}}{\partial E_{r,t}} > o, \quad \frac{\partial M_{ru,t}}{\partial L^*_{r,t}} > o,$$

where $M_{ru,t}$ is rural-urban migration, $W_{u,t}$ and $W_{r,t}$ denote the urban and rural wage rates respectively, $E_{u,t}$ and $E_{r,t}$ denote urban and rural unemployment rates respectively, and $L^*_{r,t}$ represents the labor force in rural areas.

Case II. The information may not be perfect. Since transportation and communication facilities are poor in rural areas the information may depend upon the previous migrants. The people in rural areas are not

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[34] In the literature, M.J. Greenwood and T.P. Lianos derived migration functions on the basis of time lag:

Michael J. Greenwood, "Lagged Response in the Decision to Migrate," Journal of Regional Science, Vol. 10, No. 3(December 1970), pp. 375-384.

Theodore P. Lianos, "The Migration Process and Time Lags," Journal of Regional Science, Vol. 12, No. 3(December 1972), pp. 425-433.

R.A. Hart found that inter-regional migration in Great Britain is a function of the income and employment expectation and the various groups respond somewhat differently to the economic stimuli. "Economic Expectation and the Decision to Migrate: An Analysis by Socio-Economic Group," Regional Studies, Vol. 7, pp. 271-285.

often moving during the peak season and they usually move during the off-season. Thus the potential migrants may respond to economic opportunity with a time lag.

$$M_{ru,t} = m_2(W_{u,t-1}, W_{r,t-1}, E_{u,t-1}, E_{r,t-1}, L_{r,t}) \qquad (10)$$

Case III. The argument of economic expectations in influencing the decision to migrate is that inter-regional migration is a function of the economic opportunity at a point in time as well as the economic expectations of potential migrants rather than their observation of spatial economic differentials at a point in time only. The expectation may be formed in different ways. It is hypothesized that the change of wage rates forms the expectation of future income stream.

$$M_{ru,t} = m_3(W_{u,t}, (W_{u,t} - W_{u,t-1}), W_{t,t}, (W_{r,t} - W_{r,t-1}), \qquad (11)$$
$$E_{u,t}, (E_{u,t} - E_{u,t-1}), E_{r,t}, (E_{r,t} - E_{r,t-1}), L_{r,t})$$

These three hypotheses will be examined with empirical results reported in the next chapter.

Unemployment

Unemployment is used as a measure of economic opportunity along with the wage differential in this migration study. The proper use of either unemployment or job vacancy data provides a relative measure of the tightness of the labor market. The opportunities play a substantial role in the labor surplus economy. Unfortunately, job vacancy data are not available in Korea. Unemployment data will be used for the job opportunity hypothesis. The relevancy of unemployment to job opportunity can be seen as follows:

$$\Delta U = M - \Delta E + N.$$

This defines the change in unemployment (ΔU) in terms of change in unemployment (ΔE), migration (M), and the natural increase of labor (N). When M = 0, one obtains

$$U_p = \Delta E + N + U_o$$

where U_p represents potential unemployment and U_o is the initial unemployment level. Potential unemployment is thus the negative of the change in employment plus natural increase and the initial level of unemployment. To the extent that migration is inversely related to potential unemployment it will thus vary directly with employment growth and inversely with natural increase and initial unemployment. The expected sign might be different between unemployment and job vacancy data.

$$\frac{\partial M}{\partial U_u} < 0, \qquad \frac{\partial M}{\partial U_r} > 0,$$

$$\frac{\partial M}{\partial V_u} > 0 \qquad \frac{\partial M}{\partial V_r} < 0$$

where V_u denotes the number of job vacancies in urban areas, V_r is the number of job vacancies in rural areas.

Natural increase in labor

Natural increase in labor is the difference between the number of laborers who entered the labor force and the number of laborers who leave the labor force. The expected signs of natural increase of labor force may be as follows:

$$\frac{\partial M_{ru}}{\partial N_u} < 0, \qquad \frac{\partial M_{ru}}{\partial N_r} > 0.$$

Migration may be reduced when the natural labor force in urban areas is increasing and will be increasing when natural labor force in rural areas is increasing.

Distance

Most migration studies show the significance of distance. It is recognized as an important variable in the migration model. Moves over long distance cost more than moves of shorter distance. In addition, the further one moves the likely the new area is to differ in climate or local customs from the old area. Probably more important than distance as an impediment to physical movement is distance as an impediment to flow of information. Information about distant opportunities is much more scarce than information about near opportunities. Informal social contacts diminish rapidly with distance. As we discussed in the previous chapter quite a number of explanations have been given for the decline in mobility as distance increases: distance as an impediment to mobility; and distance as a surrogate for the number of intervening opportunities. The direct movement costs as well as psychic costs increase as distance increases. This study does not include a distance variable. Since this study treats only two sectors and utilizes time series data distance may not be particularly important. Assume that distance is not changing over time. Mobility over time can be measured by using some kind of a distance related variable. However, this study does not concentrate on this area.

Growth in capital stock and the terms of trade

As mentioned earlier, growth in capital stock and the terms of trade are major explanatory variables in this study and they are both

related to wage determination. The wage rate depends on marginal productivity of labor and the output price:

$$W_u = MVP_u = MPP_{LU} \cdot P_u$$
$$W_r = MVP_r = MPP_{Lr} \cdot P_r \qquad (12)$$

where MVP_u = marginal value product of urban labor, MVP_r = marginal value product of rural labor, MPP_{Lu} = marginal physical product of labor in urban sector, MPP_{Lr} = marginal physical product of labor in rural agricultural sector, P_u = urban product price, P_r = agricultural product price.

The marginal value product of labor can be shifted due to a change in capital which influences the marginal physical productivity of labor. Heavy investment in urban areas will induce urban marginal value product of labor to shift to the right at a more rapid rate than in the rural sector.

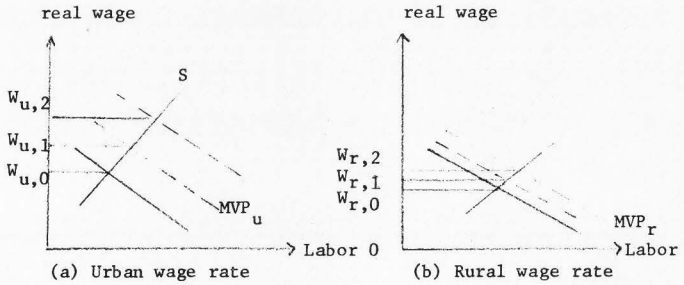


Figure 2. Demand shifts

The marginal value product of labor may also be shifted according to the changes in product prices. Unfavorable terms of trade for agricultural products means that agricultural product prices increase at a lower rate than urban product prices over time.

A critical point in the development of the labor surplus economy within the context of the classical model, occurs at the time when the marginal value product of agricultural labor begins to rise above zero. At this point, the transfer of one worker from the agricultural sector to the urban sector would reduce agricultural production and increase urban production. The neo-classical model assumes this regardless of the quantities of agricultural labor utilized or the level of development. This results in a worsening of the terms of trade for the urban sector. The commodity price is a function of quantity supplied and income. If the marginal value product of labor in the urban areas is higher than in the rural areas, the transfer of one worker would increase income. Income elasticity of urban goods is generally high, and this will offset the effect of the negative output impacts. The terms of trade, therefore, depend on the net effect of income elasticity and production in a closed economy. However, the terms of trade may not turn against urban goods in an open economy. The lower prices of foreign agricultural products may hold down the prices of domestic agricultural products and this may contribute to rural-urban migration.

As discussed above, in a typical diversified economy, the terms of trade will be determined within the economic system. But this study will treat the terms of trade exogenously because of the agricultural price policy in Korea, and for the convenience of the model. The

agricultural price policy may influence the terms of trade, and allocative aspects of labor as influenced by the change of commodity prices can be examined under this assumption. The statistical influence of this variable on migration can then be estimated according to this assumption.

The Model

A set of concepts and definitions have been clarified in previous sections. The analytical framework for the functioning of the Korean economic system was formulated into single equation and simultaneous equations models. Traditional studies of migration are largely based on single equation models. However, this study includes a simultaneous equations model which can provide a more realistic representation of the economic system as well as efficient estimates of the parameters. Symbolic notation for the variables and subscripts used in both models are defined as follows:

Symbols

$M_{ru,t}$ = the number of net labor migration from rural to urban areas at time t;

$W_{u,t}, W_{r,t}$ = real wage rate at urban and rural areas at time t respectively: urban and rural nominal wage rates divided by respective consumer price index;

$E_{u,t}, E_{r,t}$ = unemployment rate at urban and rural areas at time t respectively;

$N_{u,t}, N_{r,t}$ = natural increase in urban and rural labor at time t respectively;

$L^{*}_{u,t}, L^{*}_{r,t}$ = urban and rural labor stock at time t respectively;

$L_{u,t}, L_{r,t}$ = urban and rural labor employed at time t respectively;

$P_{u,t}, P_{r,t}$ = price indices of urban and rural agricultural products at time t respectively deflated by wholesale price index;

$K_{u,t}, K_{r,t}$ = capital stock for urban and rural agricultural production at time t with constant prices of 1970;

Q_u, Q_r = the quantities of urban and rural agricultural products respectively;

R_{ru} = returns to migrants from rural to urban areas;

C_{ru} = costs of migration.

Assumptions

1. Laborers are homogeneous.
2. Laborers possess full information about market condition in both regions.[35]
3. Workers are rational in the sense that they prefer a higher wage rate for the same work.
4. Workers have no preference for living in a particular region.
5. Conditions of work and monetary rewards other than wage rates are identical in both regions.
6. The costs of movement are constant over time.
7. The whole country is divided into non-agricultural urban areas and rural agricultural areas.
8. For simplicity we assume agricultural goods are produced in the rural areas, urban goods are produced in the urban areas, and the law of variable proportions holds in production.

[35]This assumption will be relaxed in the empirical analysis and we will assume the lagged responses on economic opportunity because of the imperfect information.

Production functions are as follows:

$$Q_u = q_u(K_u, L_u)$$

$$Q_r = q_r(K_r, L_r)$$

9. Migration is labor flow and the stock of labor in rural and urban areas changes via migration. The labor forces in rural and urban areas are given by:

$$L^*_{r,t} = L^*_{r,t-1} + N_{r,t} - M_{ru,t} \qquad (13)$$

$$L^*_{u,t} = L^*_{u,t-1} + N_{u,t} + M_{ru,t} \qquad (14)$$

Single equation model

The migration function defined in chapter II is generally used in the single equation model. Rural-urban migration may be represented as a function of the comparative economic opportunities between the two areas. The human investment model places the comparative economic opportunities into a cost and benefit framework. Potential returns at migration from rural to urban areas may be written as:

$$R_{ru} = R(W_{u,t}, E_{u,t}). \qquad (15)$$

$$C_{ru} = C(W_{r,t}, E_{r,t}). \qquad (16)$$

Migration from rural to urban areas may, then, be presented as follows:

$$M_{ru,t} = M(R_{ru}, C_{ru}, L^*_{r,t}) \qquad (17)$$

$$= M(W_{u,t}, W_{r,t}, E_{u,t}, E_{r,t}, L^*_{r,t})$$

$$\left(\frac{\partial M_{ru,t}}{\partial W_{u,t}} > o,\ \frac{\partial M_{ru,t}}{\partial W_{r,t}} < o,\ \frac{\partial M_{ru,t}}{\partial E_{u,t}} > o,\ \frac{\partial M_{ru,t}}{\partial E_{r,t}} < o,\right.$$

$$\left.\frac{\partial M_{ru,t}}{\partial L^*_{r,t}} > o\right)$$

where $L^{*}_{r,t}$ represents the labor stock in the rural areas. From the laws of migration it has been shown that populations of both regions are the variables. Economic opportunity differential will cause migration and migration will depend on the sizes of $L^{*}_{r,t}$. But this study is treating only net migration and major flow of migration was from rural to urban areas so that $L^{*}_{r,t}$ may provide a suitable proxy of populations.

As indicated in the previous chapter the form of the migration function will be represented in three alternative forms (Case I, Case II and Case III).

Simultaneous equations model

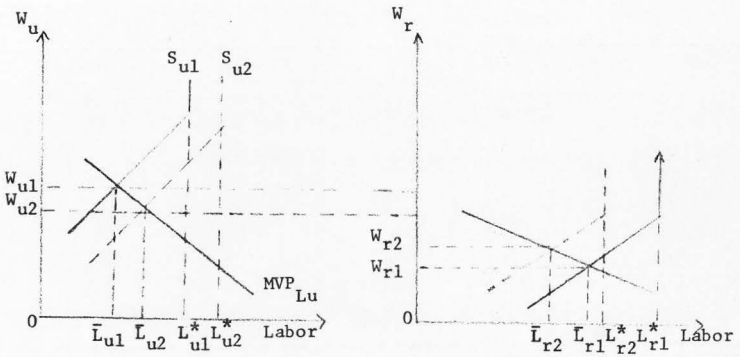
In the single equation model, the possible simultaneity among variables is not taken into account. In particular, $W_{u,t}$ and $W_{r,t}$ may be affected by migration. Migration shifts the supply of urban labor from S_{u1} to S_{u2} as depicted in Figure 3. With no change in labor demand, the wage rate in urban areas changes from W_{u1} to W_{u2} with migration which increases urban labor by $\bar{L}_{u2} - \bar{L}_{u1}$. The rural wage changes from W_{r1} to W_{r2}. The wage differentials are narrowed from $W_{u1} - W_{r1}$ to $W_{u2} - W_{r2}$. There exists an analogous relationship between migration and the product prices of both agricultural and manufacturing products. Therefore, it seems preferable to focus on the labor market and solve the system simultaneously.

Demand and supply of labor in urban areas can be defined in the following forms:

$$L_{ud} = f(W_u, P_u, K_u) \quad \left(\frac{\partial L_{ud}}{W_u} < o, \ \frac{\partial L_{ud}}{\partial P_u} > o, \ \frac{\partial L_{ud}}{\partial K_u} > o\right) \qquad (13)$$

$$L_{us} = g(W_u, L^*_{u,t}) \quad (\frac{\partial L_{us}}{\partial W_u} > o, \frac{\partial L_{us}}{\partial L^*_{u,t}} > o) \qquad (19)$$

where L_{ud} and L_{us} refer to the respective quantity of demand and supply. The quantity demanded is a function of W_u, P_u and K_u. It is known that P_u and K_u can shift demand, and that demand is an inverse function of the wage rate which is the traditional law of demand. Due to changes in P_u or K_u, or both P_u and K_u the demand curve shifts up or down.



(a) Urban wage rate (b) Rural wage rate

Figure 3. Rural and urban wage adjustment via labor shift

Labor supply is an increasing function of wage and the change in the stock of labor is assumed to labor supply. If the labor stock is increased from L^*_{u1} to L^*_{u2} the quantity supplied would be increased by AB at a fixed wage rate. In general, the changes in quantity supplied would depend on the changes in stock of labor and the slope of corresponding demand curve.

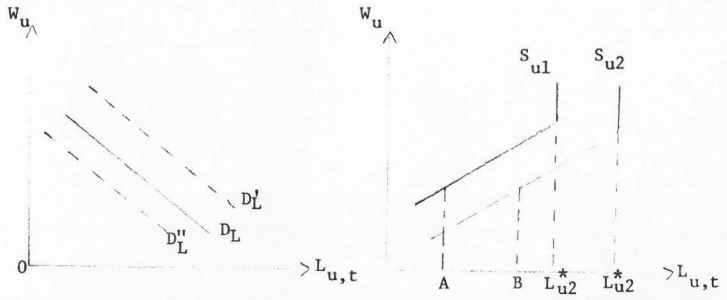


Figure 4. Shifts of demand and supply of labor

Urban P, K and L are assumed to be constant. Equilibrium in the labor market is defined by the equilibrium condition $L_{ud} = L_{us}$. Substitution of equations (18) and (19) gives

$$f(W_u, P_u, K_u) = g(W_u, L^*_{u,t}) \tag{20}$$

This equation can be written:

$$f(W_u, P_u, K_u) - g(W_u, L^*_{u,t}) = 0$$

or $$F(W_u, P_u, K_u, L^*_{u,t}) = 0 \tag{21}$$

The function F can be presumed to be explicitly solvable for $\bar{W}_u$ (the bar indicates a solution value).

$$\bar{W}_u = \bar{w}(P_u, K_u, L^*_{u,t}) \tag{22}$$

in which the equilibrium value of W_u, is expressed as a function of the other variables.

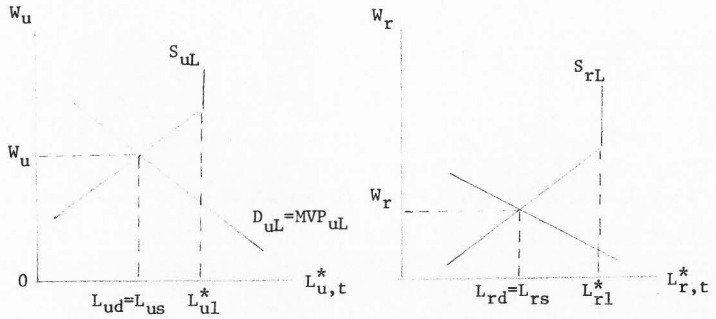


Figure 5. The equilibrium positions of the two markets

The solution value of rural wage (W_r) can be obtained from the equilibrium position of the rural labor market with the same procedure.

$$L_{rd}=r(P_r, W_r, K_r) \quad \left(\frac{\partial L_{rd}}{\partial W_r}<0, \frac{\partial L_{rd}}{\partial P_r}>0, \frac{\partial L_{rd}}{\partial K_r}>0\right) \tag{23}$$

$$L_{rs}=s(W_r, L^*_{r,t}) \quad \left(\frac{L_{rs}}{W_r}>0, \frac{L_{rs}}{L^*_{r,t}}>0\right) \tag{24}$$

$$L_{rd}=L_{rs}$$

$$r(W_r, P_r, K_r) = s(W_r, L^*_{r,t}) \tag{25}$$

or $r(W_r, P_r, K_r) - s(W_r, L^*_{r,t}) = 0$

or $G(W_r, P_r, K_r, L^*_{r,t}) = 0$

$$\bar{W}_r=\bar{w}_r(P_r, K_r, L^*_{r,t}) \tag{26}$$

Equation (22) and (26) define the solution values of the wage rates in the rural and urban markets. If $\bar{W}_u$ is larger than $\bar{W}_r$, there is an incentive to move from rural to urban areas. In other words, the wage differential could be expected to induce the rural workers to move to the

urban areas and the markets are no longer static.

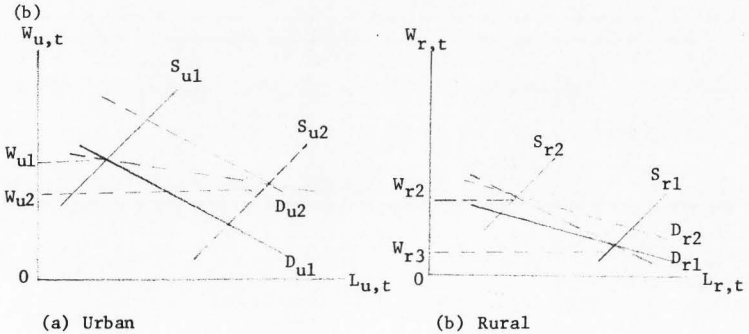
The migration problem will now be introduced into the model, and the flow of migration will be viewed as a dynamic labor market adjustment. The major difference between the dynamic process of labor market and the static market is the changes of labor stocks through the flow of migration. The changes of the labor stocks in both markets are defined as follows:

$$L^*_{u,t} = L^*_{u,t-1} + N_{u,t} + M_{ru,t} \tag{27}$$

$$L^*_{r,t} = L^*_{r,t-1} + N_{r,t} - M_{ru,t} \tag{28}$$

Migration connects the urban and rural labor markets in the model.

Equation (22) and (26) are derived from the static equilibrium position of the labor market. These conclusions, however, can be extended to the entire set of possible combinations of negatively sloped demand curves and positively sloped supply curves as depicted in Figure 6 (a) and (b).



(a) Urban (b) Rural

Figure 6. Shifts of labor demand and supply

Therefore, the system of equations as defined above may be written in the following form:

$$M_{ru,t} = m(W_{u,t}, W_{r,t}, E_{u,t}, E_{r,t}, L^*_{r,t}) \quad (29)$$

$$W_{u,t} = w_u(P_{u,t}, K_{u,t}, L^*_{u,t}) \quad (30)$$

$$W_{r,t} = w_r(P_{r,t}, K_{r,t}, L^*_{r,t}) \quad (31)$$

$$L^*_{u,t} = L^*_{u,t-1} + N_{u,t} + M_{ru,t} \quad (32)$$

$$L^*_{r,t} = L^*_{r,t-1} + N_{r,t} - M_{ru,t} \quad (33)$$

In this model, $M_{ru,t}$, $W_{u,t}$, $W_{r,t}$, $L^*_{u,t}$, $L^*_{r,t}$ are endogenous variables and others are exogenous variables. In a more complete model of the economic system $P_{u,t}$ and $P_{r,t}$ would also be endogenous variables. But they are treated as exogenous variables in this model because it makes the model manageable. This requires a careful interpretation of the economic significance of these price variables. However, the model is mathematically complete, with five endogenous variables and five equations.

The structural parameters and reduced form parameters can be estimated in this system of equations. This system provides the interaction effects and a more comprehensive understanding of the labor markets. The reduced form of (29) provides an expression of association between M_{ru} and the two economic variables--the relative changes of capital stock and the prices of products. The structural parameters of (30) and (31) may explain the present economic situation in Korea. Some economists argue that the marginal productivity of labor in the traditional sector is zero and the demand curve is

horizontal. In this case the wage rate is independent from labor change. The estimated parameters of $L^{*}_{u,t}$ and $L^{*}_{r,t}$ in (30) and (31) will show the relationship between the wage rate and the shifts of labor supply.

Data and Methodology

Data

Since the model will be tested with the Korean rural-urban labor force data we are going to discuss concepts, terminology and data sources in their Korean context.

Rural and urban areas: As is well known the concept of urban locality or urban place is defined in different ways in different countries. However, the concept of urban is almost universally understood to have reference to a relatively large and relatively densely settled population primarily engaged in non-agricultural economic pursuits. By contrast, the concept of rural ordinarily is understood to refer to relatively small and relatively sparsely settled population, typically with large proportions engaged in agriculture. The broad concensus about the nature of the difference between urban and rural notwithstanding, in actual practice the designation of localities as urban or rural varies widely and is often dependent upon administrative, political, cultural and historical as well as upon demographic or economic considerations. Definitions of urban place or locality have been classified by the United Nations into three major types:[36]

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[36]Philip M. Hauser, Handbook for Social Research in Urban Areas (Paris: UNESCO), p. 27.

1. Classification of minor civil divisions in accordance with some specified criteria such as: type of local government, number of inhabitants, or proportion of the population engaged in or directly dependent upon agriculture.

2. Designation of administrative centres of minor divisions as urban, the remainder of each division being classified rural.

3. Designation of localities or agglomerations of some specified minimum size as urban regardless of administrative arrangements or boundaries. In practice rural places are ordinarily not defined at all, but comprise rather a residual category including all non-urban places.

Within each of the categories of definitions, the specific definition of urban in Korea was granted to places more than 40,000 inhabitants until 1961. Since 1962 Korea has followed the criterion of farm and non-farm residents as urban and rural. Therefore, there is a little statistical discrepancy between 1961 and 1962. By following the latter criterion the locality of farmers or non-farmers will be a problem. The number of non-agricultural workers employed in the farm areas must be equal to the number of agricultural workers employed in the urban areas. Statistical data show that this assumption is sound because most of the non-farm industries are located in the urban areas. A small percentage of the rural population is engaged in non-farm work.

Labor force. The labor force includes all persons classified as employed or unemployed.

Employed. Employed persons comprise all civilians 14 years old or over who were at work.

Not in the labor force: This category consists of all persons 14 years old and over who are not classified as members of the labor force.

Data for the model have been collected from various secondary sources and have been estimated in a number of ways briefly outlined below.

Migration. Net migration can be measured from a population balance equation which is called the vital statistics method. The population balance equation is as follows:

$$P_t = P_{t-1} + (B-D) + I - O \tag{34}$$

$$I - O = P_t - P_{t-1} - (B - D) \tag{35}$$

where B - D represents the natural increase in population. Labor migration can be measured in the same fashion.

$$M_{ru,t} = (L_{u,t} - L_{u,t-1}) - N_{u,t} \tag{36}$$

$$M_{ru,t} = (L_{r,t} - L_{r,t-1}) - N_{r,t} \tag{37}$$

where the notations are the same as those presented earlier. From the above equations net migration can be measured if the natural increases are known. If the rate of natural increase in both sectors are the same as that of the country as a whole, this will be obtained from the labor force data. The total labor force is the sum of the rural and urban labor forces. The rate of natural increase has been calculated from the yearly total labor force. This estimate was then applied to $L_{u,t}$ and $L_{r,t}$ to estimate the natural increase in labor forces for both sectors.

Table 1. Time series data for migration, labor force, unemployment rates, wage rates, capital stock and prices of rural and urban sectors

Year	1 $M_{ru,t}$ (thousand persons)	2 $L^{*}_{u,t}$ (thousand persons)	3 $L^{*}_{r,t}$ (thousand persons)	4 $L_{u,t}+L_{r,t}$ (thousand persons)	5 $N_{u,t}$ (thousand persons)	6 $N_{r,t}$ (thousand persons)	7 $E_{u,t}$ (%)	8 $E_{r,t}$ (%)	9 $W_{u,t}$ (won)	10 $W_{r,t}$ (won)	11 $K_{u,t}$ (billion)	12 $K_{r,t}$ (billion)	13 $P_{u,t}$ (index)	14 $P_{r,t}$ (index)	15 $T_{u,t}$ (ratio)	16 $T_{r,t}$ (ratio)
1955	53.75	1213.	6436.	7649.	23.25	125.46	14.92	4.46	461.9	281.6	171.65	18.31	110.8	75.9	1.45	.68
1956	50.74	1288.	6514.	7802.	24.26	128.74	14.44	4.65	352.1	308.9	242.47	26.04	84.0	74.8	1.12	.89
1957	202.23	1513.	6427.	7940.	22.77	115.23	15.99	2.64	281.4	257.3	323.38	36.21	103.6	90.9	1.13	.87
1958	82.76	1627.	6477.	8104.	31.24	132.76	15.49	4.64	319.3	272.5	402.46	44.56	109.2	79.4	1.37	.73
1959	40.58	1729.	6681.	8410.	61.42	244.58	15.92	4.82	318.7	260.2	486.25	54.04	114.8	67.8	1.69	.59
1960	-62.25	1779.	7177.	8956.	112.25	433.75	15.91	2.13	319.0	247.0	572.16	65.14	113.5	74.1	1.53	.65
1961	38.95	1975.	7522.	9497.	295.17	383.95	9.51	.59	326.1	241.1	662.34	79.41	111.1	77.5	1.43	.70
1962	479.02	3364.	6429.	9793.	909.98	-613.98	12.66	4.18	316.4	223.2	784.48	90.65	109.1	77.1	1.41	.71
1963	399.60	3372.	5281.	8653.	-391.60	-748.40	16.43	2.86	293.7	300.9	934.83	108.09	100.0	93.7	1.07	.94
1964	-13.91	3452.	5442.	8894.	93.91	147.09	14.37	3.44	311.8	312.5	1070.70	127.34	98.7	88.6	1.14	.89
1965	182.77	3762.	5434.	9196.	127.23	174.77	13.56	3.10	335.6	347.9	1242.36	151.08	106.5	81.6	1.30	.76
1966	84.22	3899.	5426.	9325.	52.78	76.22	12.77	3.10	346.7	359.5	1501.56	186.16	106.9	82.0	1.30	.77
1967	215.14	4189.	5315.	9504.	74.86	104.14	10.65	2.33	387.1	385.9	1828.71	217.64	105.9	84.8	1.25	.80
1968	133.49	4434.	5323.	9757.	111.51	141.49	8.93	1.88	426.7	413.6	2291.03	292.85	104.0	88.5	1.18	.85
1969	128.29	4590.	5228.	9818.	27.71	33.29	7.80	2.16	514.7	461.7	2891.03	292.85	101.5	96.2	1.06	.95
1970	226.59	4911.	5109.	10020.	94.41	107.59	7.45	1.57	571.0	500.4	3488.86	345.22	100.0	100.0	1.00	1.00
1971	264.94	5247.	5918.	10165.	71.06	73.94	7.34	1.46	601.7	536.2	4113.70	401.01	97.3	112.2	.86	1.15
1972	-11.94	5363.	5137.	10500.	12.794	20.706	7.55	1.34	614.5	555.0	4700.87	472.98	94.9	122.9	.77	1.30
Total	2484.97	57707.	106276.	163983.	1755.004	1081.326	221.69	51.35	7098.4	6265.4	27709.52	2969.67	1871.8	1568.0	23.44	15.95
Average	138.60	3205.944	5904.222	9110.155	97.500	60.073	12.31	2.85	394.4	348.1	1539.41	164.98	103.9	87.1	1.23	.84

Units are presented in the bracket of each variable. The values of all variables except the labor force related variables are price deflated. The nominal wage rates and price indices used as price deflator are shown in Appendix B. $1 ≒ 485 won.

Sources:

1. Estimated from the labor force data.
2,3,4: Bureau of Statistics, Economic Planning Board, Republic of Korea, Korea Statistical Yearbook (1952-1973).
5,6: Estimated from the labor force data.
7,8: Korea Statistical Yearbook.
9: Korea Statistical Yearbook.
10: Ministry of Agriculture and Forestry, Republic of Korea, Yearbook of Agriculture and Forestry Statistics.
11, 14, 15, 16, 17: The Bank of Korea, Economic Statistics Yearbook.

Real wage rate. Real wage rates are the urban and rural nominal wages divided by urban and rural consumer price index respectively. Urban and rural nominal wages were obtained from the statistical year book of Bureau of Statistics of Economic Planning Board. Nominal wages in urban areas are approximated by a weighted average of wages in all urban industries for all classifications of employees. The rural wages are also the weighted average of wages of male and female agricultural workers. The rural nominal wage data were available since 1958. The agricultural wage data for the period, 1955-1957 are estimated on the basis of the prices of agricultural products.[37] Urban and rural consumer price indices are not complete and they are estimated on the basis of Seoul consumer price index and wholesale price index respectively which were available for the entire observation period. Detailed information for these variables is presented in appendix B.

Unemployment. Unemployment as a job opportunity hypothesis has been discussed in chapter III. The numbers of the unemployed for the farm and nonfarm household were obtained from the statistical year book. The rural and urban unemployment rates are the numbers of the farm and non-farm unemployed divided by the rural and urban labor force respectively.

Product prices. These variables represent the terms of trade between urban and rural goods. In the statistical year book these data are available in the form of an index of prices received by

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[37]The wages were paid usually by rice and one half bushel of rice could buy about 2.5 days of man's labor service in those times. Employer also served foods so that nominal wages has been adjusted as well as trend of wage rates.

farmers, and an index of prices, wages and charges paid by farmers. However, these data are not listed until 1962 and data have, therefore, been collected from the detailed commodity price index for the entire period. For the years in which direct comparison was possible data from the latter source were found to be very close to those obtained from the statistical year book.

Capital: Estimates of the cumulative stock of capital are not available but the investment data are available. These annual investment data were aggregated and have been used as the capital stock variable. These data should provide an adequate representation of the variation in capital stock in both sectors for the estimation of the parameters in the model. The estimated coefficients of the variables will not be biased except the intercept terms.[38] All of these data are presented in table 1.

Methodology

The equations (29), (30), (31), (32) and (33) can be written in the following estimable linear forms:

$$M_{ru,t} = a_o+a_1W_{u,t}+a_2W_{r,t}+a_3E_{u,t}+a_4E_{r,t}+a_5L^*_{r,t}+v_{1,t} \quad (38)$$

$$W_{u,t} = b_o+b_1P_{u,t}+b_2K_{u,t}+b_3L^*_{u,t}+v_{2,t} \quad (39)$$

$$W_{r,t} = c_o+c_1P_{r,t}+c_2K_{r,t}+c_3L^*_{r,t}+v_{3,t} \quad (40)$$

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[38] Capital stock is changing through capital formation and the parameters are influenced by the deviation from the arithmetic means. The initial capital stock will affect only the intercept term in the model and will not affect the other parameters. See the Appendix A for the full proof.

$$L^*_{u,t} = L^*_{u,t-1} + N_{u,t} + M_{ru,t} \tag{41}$$

$$L^*_{r,t} = L^*_{r,t-1} + N_{r,t} - M_{ru,t} \tag{42}$$

where $M_{ru,t}$, $W_{u,t}$, $W_{r,t}$, $L^*_{u,t}$, and $L^*_{r,t}$ are endogenous variables, and $E_{u,t}$, $E_{r,t}$, $P_{u,t}$, $P_{r,t}$, $K_{u,t}$, $K_{r,t}$, $N_{u,t}$ and $N_{r,t}$ are exogenous variables. Model dictates that a_1, a_4, a_5, b_1, b_2, c_1 and c_2 will have positive signs, and a_2, a_3, b_3 and c_3 will have negative signs.[39]

With conventional notation the structural equations may be written as:

$$Y = Y B^* + X C^* + U \tag{43}$$

where Y represents endogenous variables and X is exogenous variables. If the system determines the values of the current endogenous variables in terms of the predetermined variables and the error terms of the system, then the matrix $I - B^*$ must be nonsingular. The system may be solved to yield

$$Y = C^* (I - B^*)^{-1} X + U(I - B^*)^{-1} \tag{44}$$

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[39] According to the migration theory the expected sign of the parameters of the equation (38) are as follows:

$$\frac{\partial M_{ru,t}}{\partial W_{u,t}} = a_1 > 0, \quad \frac{\partial M_{ru,t}}{\partial W_{r,t}} = a_2 < 0, \quad \frac{\partial M_{ru,t}}{\partial E_{u,t}} = a_3 < 0,$$

$$\frac{\partial M_{ru,t}}{\partial E_{r,t}} = a_4 > 0, \quad \frac{\partial M_{ru,t}}{\partial L^*_{r,t}} = a_5 > 0.$$

The expected sign for b_1 can be determined from the equations (20, (21) and (22).

$$\frac{\partial \bar{W}_u}{\partial P_u} = \frac{F_{P_u}}{F_{W_u}} = \frac{\frac{\partial L_{u,d}}{\partial P_u}}{\frac{\partial L_{u,d}}{\partial W_u} - \frac{\partial L_{u,s}}{\partial W_u}} > 0$$

Since

If we put $C^*(I - B^*)^{-1} = \Pi$, $(I - B^*)^{-1} = D$, and $UD = V$ we may write (44) in the compact notation

$$Y = X\Pi + V$$

The operation of an economic system may be described by the set of equations and such a system is said to be a system of structural equations. If the system is such that the predetermined variables uniquely determine the current endogenous variables, then the system may be solved as in (45). This set of equations is said to be a reduced form system.

In the fundamental economic sense, the property that characterizes a structural system is the assertion that it describes adequately the precise fashion in which all the current endogenous and predetermined variables mutually interact within the specified economic system. Thus, as of a given moment of time, observations on the system represent the result of such interaction. A reduced form system, on the other hand, gives only a partial view of that interaction, for it merely describes the way in which the predetermined variables serve to influence the behavior of the current endogenous variables, after all interactions among jointly dependent variables have been allowed for.

In general, the reduced form shows the equilibrium impact of a change in any exogenous variable on each endogenous variable. Thus, an economist often finds it useful to transform the structural system into its reduced form in order to answer policy questions. The present

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$\frac{\partial L_{u,d}}{\partial P_u} > 0$, $\frac{\partial L_{u,d}}{\partial W_u} < 0$, $\frac{\partial L_{u,s}}{\partial W_u} > 0$. Therefore, $\frac{\partial W_{u,t}}{\partial P_{u,t}} = b_1 > 0$.

With the same technique the expected signs of the parameters b_2, b_3, c_1, c_2 and c_3 can be found.

study will provide both the structural and reduced form estimations to examine the fundamental functions of the economic system and questions related to investment and price policies.

The model as developed is over identified which means that the numbers of the hypothetically excluded predetermined variables are greater than the number of included endogenous variables in order conditions of identification. The rank conditions of the identification are all satisfied. Therefore, two stage least squares methods were employed to estimate the structural parameters of the system. Monte Carlo studies indicate that the two stage least squares method is the best technique for the overidentified system. However, the problem of test-statistics is not clearly solved for the structural estimation.

$$Y = X\hat{\Pi} + V \tag{46}$$

For the above reduced form we can test hypotheses about $\hat{\Pi}$ and $\hat{\Sigma}$ by using regular regression tests.

$$\pi_{ij} \sim N(\hat{\Pi},\hat{\Sigma}) \tag{47}$$

where $\hat{\Sigma}$ represents the variance covariance matrix of the reduced form estimates. By assuming normality a t test can be used for π_{ij}'s and chi-square or the Wishurt F test for the $\hat{\Sigma}$. The F and t-statistics are not necessarily the appropriate test-statistics for the structural parameters $(\hat{B},\hat{C},\hat{\Omega})$.[40] However, convention suggests that both F and the t tests can be used as proxies for the appropriate test-statistics.

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[40]Basmann pointed out that 2SLS estimators of the structural parameters do not possess the finite first or second moments. R.L. Basmann, "A note on the Exact Finite Sample Frequency Functions of Generalized Classical Linear Estimators in Two Leading Over-identified Cases," Journal of American Statistical Association, Vol. 56(1961), pp. 619-636.

Richardson and Rohr propose a structural t test used in testing hypotheses about the structural coefficients of endogenous variables and

CHAPTER IV

EMPIRICAL RESULTS

This chapter is divided into two major sections: (1) a brief survey of the model; (2) a summary of the results. The first section gives an overall view of the statistical results of the three cases studied. The statistical significance and implications of the structural and reduced form parameters are examined in detail in the second section. The discussion extends to the simultaneous equations model and the single equations model.

The system of equations in the simultaneous model includes three behavioral equations and two identities. Equations (38), (39) and (40) are behavioral equations and (41) and (42) and the identities. Equation (38) can be presented in several different forms which reflect alternative behavioral hypotheses for migration. As mentioned in the

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indicate in what instances the student t test will provide an accurate proximation to the exact distribution function. D.H. Richardson and Robert J. Rohr, "Distribution of a Structural t-statistic for the Case of Two Induced Endogenous Variables," Journal of the American Statistical Association, Vol. 66, No. 334 (June 1971), pp. 375-382.

Basmann and Richardson derived an $F_2(U)$ function. Ebbeler and McDonald indicate that the error involved when the $F_2(U)$ distribution function, $\bar{F}_2(U)$ is used to approximate $F_2(U)$.

Basmann and Richardson, "The Exact Finite Distribution of a Nonconsistent Structural Variance Estimator," Econometrica, Vol. 41, No. 1 (January 1973), pp. 41-58.

Donald H. Ebbeler and James B. McDonald, "An Analysis of the Properties of the Exact Finite Sample Distribution of a Nonconsistent GCL Structural Variance Estimator," Econometrica, Vol. 41, No. 1 (January 1973), pp. 59-65. Author's present knowledge on this subject is due to Professor McDonald's discussions.

previous chapter three distinct behavioral patterns of migrants have been offered: (Case I) The migrants respond to the current wage and job opportunity differentials; (Case II) the migrants respond to the economic opportunity differentials with a time lag; (Case III) the migrants respond to current as well as expected economic opportunity differentials. The structural parameters were estimated by the two stage least squares method for each case and the reduced form parameters were estimated by the simple regression method. Equations (39) and (40) were not changed despite the migrants' patterns since they represent the behavioral response to wages in the rural and urban labor markets.

A Brief Survey of the Models

Table 2 summarizes the results of the two stage least squares estimates of the parameters in the three cases for the three structural equations. In Case II, the scores of the R^2 and F test-statistics of the migration function appeared to be relatively high compared to the results in the other two cases. The R^2's of the rural and urban wage equations were high in all three cases. The high scores of the coefficients of determination of the model may be partly due to serial correlation in the time series data. D.W. is the Durbin-Watson statistic which tests for the presence of serial correlation in the error terms of a simultaneous equation system. Although its use in Cases II and III may be inappropriate,[41] the results do not indicate strongly

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[41] Since the underlying assumptions are those of a standard linear model including normality, the assumption of normality indicates the exclusion of the presence of lagged values of the dependent variable among the explanatory variables.

that the customary assumption of intertemporal uncorrelatedness is violated except in the Case III. The D.W. ratios of the equations in Case III fall within the external range of .90 and 1.71, indicating inconclusiveness about the hypothesis with respect to independence on the error term.

The numbers in parentheses are the t-ratios computed by analogy with simple general linear model. Although the use of F and t test-statistics may not be appropriate in the present study, the results show that null hypotheses are generally acceptable except in a few cases. Levels of significance and t-ratios are summarized in Table 2.

The major distinction of Cases II and III from Case I is that the models are dynamic in the sense that Cases II and III involve difference equations. In a dynamic analysis, the timeless multiplier, the intermediate run responses, and instaneous impact can be examined. The present study will discuss only the instantaneous impact. The time path of response can be easily traced out if information on the instantaneous impact is available. The period or time path analysis can be important for policy purposes. However, this study is mainly interested in the economic analysis and economic function of the system. Once the initial situation has been specified, the time path analysis is determined by the time path of the exogenous variables that determines the time path of the endogenous variables.

The parameters of the migration function (38) and the rural and urban wage functions (39) and (40) indicate some contradictory results among the three cases. The estimated coefficients of the migration

function show the expected signs with the exception of the rural employment and labor force variables in Case I. The urban wage rate and rural labor force coefficients are exceptions in Case II. The urban unemployment and the rural labor force coefficients conform to expectations in Case III. The parameters of the wage functions are similar with the exception of Case II. In general, Case I seems to show the most reasonable results according to conformity of statistical results with hypotheses based on the economic model.

Summary of the Results

This section discusses the structural and reduced form parameters of the models, and single and simultaneous systems of the model. Reduced form parameters are estimated for Cases I and II. The reduced form parameters are not estimable for Case III because the numbers of variables are greater than the numbers of the observations.

The regression results are presented in Tables 2, 4, and 6. Table 2 gives the regression results of the three cases for the three structural equations. Table 3 shows the derivation of the reduced form based on the coefficients of the structural forms. Tables 4 and 6 present the regression results for the reduced forms. The impact multipliers, the matrix of the coefficients of the reduced form, are presented in Tables 5 and 7. Table 8 presents the statistical results of the single equation and simultaneous equations models.

Statistical results for Cases I, II and III are summarized in Table 9. The criteria used for ranking variables in Table 9 were as follows:

Strongly agree: Expected sign and significantly different from zero at the conventional test levels ($0.001 < \alpha < 0.01$).

Agree: Expected sign but not significantly different from zero at the conventional test levels.

Disagree: Unexpected sign but not significantly different from zero at the conventional test levels.

Strongly disagree: Unexpected sign but significantly different from zero at the conventional test levels.

Most of the coefficients were significantly different from zero at the conventional test levels. The coefficients of the reduced form estimates, generally have the expected signs as well. The statistical significance and implication of the coefficients of the structural forms and reduced forms are discussed below. A summary is presented in order to provide a clearer picture of the empirical result.

Structural form

Urban unemployment rates ($E_{u,t}$) support the hypothesis very strongly. Since higher urban unemployment rates were hypothesized to discourage potential migrants from entering the urban labor market by signalling a surplus of labor or scarce job opportunities, the urban unemployment rate was hypothesized to have a negative sign. In all cases, the urban unemployment rate had a negative coefficient signifying that it is a definite deterrent to rural-urban migration.

The urban and rural wage rates ($W_{u,t}$ and $W_{r,t}$) appear to support the economic opportunity hypothesis. The urban wage rate was positively related with rural-urban migration and the rural wage rate shows an inverse relationship to migration. Factor mobility theory

Table 2. Summaries of the estimates of simultaneous equations model

Case I:

$$M_{ru,t} = 3638.4 + 4.15\ W_{u,t} - 7.17\ W_{r,t} - 8.68\ E_{u,t} - 23.50\ E_{r,t} - 0.413\ L^{*}_{r,t}$$

$$(8.773)^{*}\ (2.894)^{**}\quad (3.759)^{*}\quad (0.441)\quad (0.697)\quad (4.073)^{*}$$

$$R^2 = .59\quad D.W. = 2.396\quad F(5,11) = 3.188$$

$$W_{u,t} = 218.46 + 0.551\ P_{u,t} + 0.0938\ K_{u,t} - 0.0136\ L^{*}_{u,t} \qquad (48)$$

$$(2.640)^{**}\ (0.725)\quad (7.819)^{*}\quad (1.071)$$

$$R^2 = .97\quad D.W. = 1.938\quad F(3,13) = 143.51$$

$$W_{r,t} = 393.06 - 0.422\ P_{r,t} + 0.700\ K_{r,t} - 0.0223\ L^{*}_{r,t}$$

$$(2.792)^{**}\ (0.441)\quad (5.054)^{*}\quad (1.389)^{***}$$

$$R^2 = .95\quad D.W. = 2.339\quad F(3,13) = 101.03$$

Case II:

$$M_{ru,t} = 1946.39 - 0.439\ W_{u,t-1} - 1.714\ W_{r,t-1} - 64.206\ E_{u,t-1} + 14.256\ E_{r,t-1} - 5.003\ L^{*}_{r,t}$$

$$(5.541)^{*}\quad (1.121)\quad (3.341)^{*}\quad (4.283)^{*}\quad (.593)\quad (1.106)$$

$$R^2 = .76\quad D.W. = 2.137\quad F(5,11) = 7.676$$

$$W_{u.t} = 212.65 - 0.408\ P_{u,t} + 0.749\ K_{u,t} + 0.125\ L^{*}_{u,t} \qquad (49)$$

$$(2.410)^{**}\ (0.611)\quad (4.389)^{*}\quad (.615)$$

$$R^2 = .94\quad D.W. = 1.741\quad F(3,13) = 85.97$$

Table 2. Continued

$$W_{r,t} = 247.0 - 0.604\ P_{r,t} + 0.802\ K_{r,t} + 0.00272\ L^{*}_{r,t}$$

$$(1.940)^{**}\quad (.587)\qquad (5.815)^{*}\qquad (.293)$$

$$R^2 = .94\quad D.W. = 2.084\quad F(3,13) = 85.48$$

Case III:

$$M_{ru,t} = 860.16 - 2.501\ W_{u,t} - 0.732\ (W_{u,t} - W_{u,t-1}) + 1.368\ W_{r,t} + 1.535\ (W_{r,t} - W_{r,t-1}) - 64.394 E_{u,t}$$

$$(1.148)\quad (2.920)^{**}\qquad (0.986)\qquad (1.453)^{***}\quad (1.253)\qquad (1.867)^{***}$$

$$+ 71.509\ (E_{u,t-1}) - 21.185\ E_{r,t} - 5.588\ (E_{r,t} - E_{r,t-1}) + 0.109\ L^{*}_{r,t}$$

$$(3.241)^{**}\qquad (.320)\qquad (.581)\qquad (1.299)$$

$$R^2 = .71\quad D.W. = 2.503\quad F(9,9) = 2.515$$

$$W_{u,t} = 221.83 + 1.550\ P_{u,t} + 1.234\ K_{u,t} - 0.05537\ L^{*}_{u,t} \qquad (50)$$

$$(1.985)^{**}\quad (1.808)^{**}\qquad (7.578)^{*}\qquad (3.494)^{*}$$

$$R^2 = .86\quad D.W. = 1.096\quad F(3,15) = 31.30$$

$$W_{r,t} = 277.27 - 0.294\ P_{r,t} + 0.745\ K_{r,t} - 0.00461\ L^{*}_{r,t}$$

$$(2.174)^{**}\quad (.269)\qquad (8.781)^{*}\qquad (0.558)$$

$$R^2 = .92\quad D.W. = 0.992\quad F(3,15) = 63.08$$

where the numbers in the parentheses are t ratios and
* = significant at the 1 percent level
** = significant at the 5 percent level
*** significant at the 10 percent level

hypothesis migration flows from lower factor payments areas to higher factor payments areas. Thus, the signs of the rural and urban wage variables imply that the Korean economic system was functioning as the theory predicts over the period of this analysis.

The second and third equations of the system present the relationships between the wage rate and economic conditions such as product prices, magnitude of capital and the quantity of labor supply. Most of the coefficients of the variables for these two equations had relatively high t-scores and expected signs.

The coefficients of the capital variables ($K_{u,t}$ and $K_{r,t}$) were of special interest. It was hypothesized that these variables were positively related with wage rates. The coefficients support these hypotheses in both rural and urban areas. The coefficients of the capital variables were highly significant and had expected signs. Theory predicts that capital increases in urban (rural) areas will increase the marginal product of urban labor (rural labor), entailing a rightward shift in the demand curve for urban labor (rural labor), and thereby causing the wage rate to rise. The positive signs of the capital variables in both rural and urban areas support this explanation.

The coefficient of the prices of urban goods ($P_{u,t}$) was in general significant and had the expected sign. As the prices of urban goods increase, the demand curve for labor will shift upward and the urban wage rate will increase, thus, the partial derivative of the urban wage rate with respect to the price of urban goods was expected to be positive. The empirical results of this study conform with these expectation.

Estimates of the supplies of labor coefficients in both rural and urban sectors ($L^*_{r,t}$ and $L^*_{u,t}$) give satisfactory results. An increase in the supply of labor should lower the wage rate, while a decrease in the supply of labor should increase the wage rate. The negative signs of the labor stock variables in the urban and rural wage equations provide evidence in support of these expected relationship. Since the data showed that the urban labor stock was increasing and the rural labor stock was decreasing, the negative signs imply that the urban wage rate was decreasing as the urban labor stock increased and the rural wage rate was rising as the rural labor stock decreased.

The sign of the estimated coefficient of the prices of rural goods ($P_{r,t}$) was negative. This is contrary to the theory. However, there is a good chance that during the observed time period the labor supply curve decreased as the demand curve decreased. Since interactions of the endogenous variables are allowed for in this model, the wage rate will rise over a period of time if the supply curve for labor shifts leftward faster than the demand curve of labor; there will be no change in the wage rate if both curves shift leftward at the same rate; and the wage rate will decline if the demand curve of labor shifts leftward faster than the supply curve for labor. The empirical results of this study conform to the first case in the rural sector because the relative prices of rural goods were low for most of the observed time period. Thus, the result of the rural price variable is seemingly disappointing, but can be rationalized in terms of data from the Korean economy over the time period treated in this study.

While the lagged value of the rural wage rate strongly supports the hypothesis, the lagged value of the urban wage rate gives a disappointing result as shown in Table 2. The coefficients of the wage differential variables ($W_{u,t}-W_{u,t-1}$ and $W_{r,} - W_{r,t-1}$) were neither highly significant nor of the expected signs. The coefficients of the unemployment differential variables have unexpected signs and were not statistically significant.

The coefficient of rural unemployment variable ($E_{r,t}$) was neither significant nor of the expected sign. The coefficient had a negative sign which means as the rural unemployment rate decreases, migration increases or, alternatively, as the rural unemployment rate increases migration decreases. Evidence presented in Table 1, suggests that the situation belongs to the former possibility. Why did labor continue to move into the urban sector even though the employment opportunity was improving in the rural sector. Since the unemployment variable is generally regarded as an important explanatory variable and since there are lively discussions on this variable in the literature, the answer to this question needs further explanation.

First, there may be a problem of error in measuring rural unemployment. The unemployment data may not give an adequate representation of seasonal fluctuations in unemployment in the rural sector. Also, there is a strong possibility that unemployment is under-reported in the rural sector due to the existence of self employment. The vector of true values of rural unemployment is orthogonal to the vectors corresponding to the rest of the variables, so the coefficients of rural unemployment may be subject to bias

while the other coefficients are not.[42] A few attempts to solve this problem can be found in the literature, but solving this sort of problem was judged to be beyond the scope of these studies.

Secondly, the questions regarding the explanatory power of unemployment have been raised in other migration studies. Blanco and Mazek developed new concepts - prospective unemployment and potential unemployment[43] - to demonstrate that unemployment is a powerful explanatory variable in migration. However, Muth indicated that there is a simultaneity between migration and unemployment so that neither prospective nor potential unemployment may be a proper explanatory variable in predicting migration.[44] He examined the relationship between migration and employment growth by using data on U.S. cities.

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[42]Henri Theil, Principles of Econometrics (New York, London, Sydney and Toronto: John Wiley & Sons, Inc., 1971), p.607.

[43]Cicely Blanco, "Prospective Unemployment and Interstate Population Movements," The Review of Economics and Statistics Vol. 46, No. 2 (May 1964), pp. 221-222. She defined prospective unemployment as the actual rate of change in unemployment which would be expected to occur if workers were not able to migrate between states. It is measured by the difference between the actual rate of change of employment and the actual rate of increase in the working-age population in each state.

Warren F. Mazek, "Unemployment and The Efficacy of Migration: The Case of Laborers," Journal of Regional Science, Vol. 9, No. 1 (1969). He defined the potential unemployment rates as the unemployment rates for laborers which would exist in a region at the end of the period (1960) if no labor migration, in or out, took place over the period (1955-1960). It is estimated by first estimating the size of the labor force at the end of the period, assuming no migration, and subtracting this result from the actual unemployment of laborers at the end of the period.

[44]Richard F. Muth, "Migration: Chicken or Egg?" Southern Economic Journal, Vol. 37, No. 3 (January 1971), pp. 295-306.

His study found empirical evidence supporting the Borts-Stein[45] hypothesis that employment growth is itself induced by net in-migration. He also confirmed his earlier conclusion that migration and employment growth each affect and are affected by the other.[46] Muth s main concern was with receiving areas, whereas the problem in the present study is related to the rural sector which has experienced negative net migration. In this case, rural unemployment and the expectation of its change seem to be affected by net out-migration. Unemployment could possibly be decreasing due to the continuous out-migration. As out-migration increases, the unemployment expected in rural areas might decrease and thereby affect the labor market adjustment process. Therefore, the estimate of parameter for rural unemployment may not be efficient.

Finally, some economists argue that people migrate to urban areas despite high urban unemployment. In other words, unemployment is not considered to be a significant factor in rural-urban migration in developing countries. Todaro[47] provided an economic rationale for rural-urban labor migration in less developed countries which takes account of this argument. In his model, the decision to

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[45]George H. Bort and Jerome L. Stein, Economic Growth in a Free Market (New York and London: Columbia University Press, 1964).

[46]This conclusion appears in the paper, "Differential Growth Among Large U.S. Cities," in Papers in Quantitative Economics, edited by James P. Quirk and Arvid M. Zarley (Lawrence and London: The University Press of Kansas, 1968), pp. 311-355.

[47]Michael P. Todaro, "A Model of Labor Migration and Urban Development in Less Developed Countries," American Economic Review, Vol. 49 (March 1969), pp. 138-148.

John R. Harris and M.P. Todaro. "Migration, Unemployment and Development: A Two Sector Analysis," American Economic Review, Vol. 50 (March 1970), pp. 126-142.

migrate from rural to urban areas is functionally related to two principle variables: (1) the urban-rural real income differential; and (2) the probability of obtaining an urban job. He concluded that as long as the urban-rural real income differential continues to rise sufficiently fast to offset any sustained increase in the rate of job creation, then even in spite of the long-run stabilizing effect of a lower probability of successfully finding modern sector employment, the lure of relatively higher permanent incomes will continue to attract a steady stream of rural migrants into the ever more congested urban slums. Todaro's analysis seems to be a reasonable explanation for the rural-urban migration in Korea. Additionally, it is noted that the t-ratio of the estimated coefficient of rural unemployment implies that one or all of these conditions may have affected the estimates. The problem of relating unemployment and migration, despite being widely discussed in the literature, has not been resolved yet and requires further research.

The labor stock variable ($L^{*}_{r,t}$) is hypothesized to have a positive sign for its coefficient, but it has a negative sign indicating that a decrease in the rural labor stock results in migration increases. Since the labor stock is endogenous variable and the data used are time series, the rural labor stock is continuously decreasing in the case of the two regions as rural-urban migration continues. When the cross-section data collected from the multi-regions it is expected to have a positive sign. Thus, the sign may be appropriate for this particular labor market adjustment process.

Reduced form

The relative economic opportunities are changed through economic activities such as the prices of rural and urban goods and the magnitudes of capital stocks in rural and urban areas. The major part of this study is addressed to an examination of the effects of such economic activities on migration. These can be examined in the reduced forms obtained from the simultaneous equations system. For analytical purposes as well as for simple prediction, the reduced forms are the more relevant version of the model. The coefficients of the reduced forms represent the impact multipliers in the sense that each measures the change in an endogenous variable induced by a unit change in a predetermined variable, with all other predetermined variables held constant. The submatrix of the reduced form coefficients is termed the matrix of impact multipliers and its elements represent the first year effects on the endogenous variables.

Most coefficients are significantly different from zero at the conventional test levels and have the expected signs in reduced form estimation. Traditionally, it has been said that rural-urban migration is due to the pressure of natural increase on the rural labor force. This argument can be examined by substituting $L^*_{u,t}$ and $L^*_{r,t}$ for $L^*_{u,t-1} + N_{u,t} + M_{ru,t}$ and $L^*_{r,t} = L^*_{r,t-1} + N_{r,t} - M_{ru,t}$ respectively. They may be called quasi-reduced forms in the sense that these forms have endogenous variables on the right hand side.

Table 3. Reduced form for case I

$$M_{ru,t} = \frac{a_o + a_1b_o + a_2c_o}{(1 - a_1b_3 + a_2c_3 + a_5)} + \frac{a_1b_1}{(\quad)} P_{u,t} + \frac{a_2c_1}{(\quad)} P_{r,t} + \frac{a_1b_2}{(\quad)} K_{u,t} + \frac{a_2c_2}{(\quad)} K_{r,t} \tag{51}$$

$$+ \frac{a_1b_3}{(\quad)} L^*_{u,t-1} + \frac{a_1b_3}{(\quad)} N_{u,t} + \frac{(a_2c_3+a_5)}{(\quad)} L^*_{r,t-1} + \frac{(a_2c_3+a_5)}{(\quad)} N_{r,t} + \frac{a_3}{(\quad)} E_{u,t} + \frac{a_4}{(\quad)}$$

$$+ \frac{a_1v_2+a_2v_3+v_1}{(\quad)}$$

$$W_{u,t} = b_o + \frac{b_3(a_o + a_1b_o + a_2c_o)}{(\quad)} + (b_1 + \frac{b_3a_1b_1}{(\quad)}) P_{u,t} + \frac{b_3a_2c_1}{(\quad)} P_{r,t} + (b_2 + \frac{b_3a_1b_2}{(\quad)}) K_{u,t}$$

$$+ \frac{b_3a_2c_2}{(\quad)} K_{r,t} + (b_3 + \frac{a_1b_3^2}{(\quad)}) L^*_{u,t-1} + (b_3 + \frac{a_1b_3^2}{(\quad)}) N_{u,t-1} + \frac{b_3(a_2c_3+a_5)}{(\quad)} L^*_{r,t-1} \tag{52}$$

$$+ \frac{b_3(a_2c_3 + a_5)}{(\quad)} N_{r,t} + \frac{b_3a_3}{(\quad)} E_{u,t} + \frac{b_3a_4}{(\quad)} E_{r,t} + \frac{b_3(a_1v_2 + a_2v_3 + v_1)}{(\quad)} + v_2$$

$$W_{r,t} = c_o - \frac{c_3(a_o+a_1b_o+a_2c_o)}{(\quad)} - \frac{c_3(a_1b_1)}{(\quad)} P_{u,t} + (c_1 - \frac{c_3(a_2c_1)}{(\quad)}) P_{r,t} - \frac{c_3a_1b_2}{(\quad)} K_{u,t} \tag{53}$$

$$+ (c_2 - \frac{c_3a_2c_2}{(\quad)}) K_{r,t} - \frac{c_3a_1b_3}{(\quad)} L^*_{u,t-1} - \frac{c_3a_1b_3}{(\quad)} N_{u,t} + (c_3 - \frac{c_3(a_2c_3 + a_5)}{(\quad)}) L^*_{r,t-1}$$

$$+ (c_3 - \frac{c_3(a_2c_3 + a_5)}{(\quad)}) N_{r,t} - \frac{c_3a_3}{(\quad)} E_{u,t} - \frac{c_3(a_1v_2 + a_2v_3 + v_1)}{(\quad)} + v_3$$

Table 3. Continued

$$L^*_{u,t} = \frac{a_o + a_1 b_o + a_2 c_o}{(\quad)} + \frac{a_1 b_1}{(\quad)} P_{u,t} + \frac{a_2 c_2}{(\quad)} P_{r,t} + \frac{a_1 b_2}{(\quad)} K_{u,t} + \frac{a_2 c_2}{(\quad)} K_{r,t} + \left(\frac{a_1 b_3}{(\quad)} + 1\right) L^*_{u,t-1}$$

$$+ \left(\frac{a_1 b_3}{(\quad)} + 1\right) N_{u,t} + \frac{(a_2 c_3 + a_5)}{(\quad)} L^*_{r,t-1} + \frac{(a_2 c_3 + a_5)}{(\quad)} N_{r,t} + \frac{a_3}{(\quad)} E_{u,t} + \frac{a_4}{(\quad)} E_{r,t} \qquad (54)$$

$$+ \frac{a_1 v_2 + a_2 v_3 + v_1}{(\quad)}$$

$$L^*_{r,t} = \frac{a_o + a_1 b_o + a_2 c_o}{(\quad)} - \frac{a_1 b_1}{(\quad)} P_{u,t} - \frac{a_2 c_1}{(\quad)} P_{r,t} - \frac{a_1 b_2}{(\quad)} K_{u,t} - \frac{a_2 c_2}{(\quad)} K_{r,t} - \frac{a_1 b_3}{(\quad)} L^*_{u,t-1}$$

$$- \frac{a_1 b_3}{(\quad)} N_{u,t} + \left(1 - \frac{a_2 c_3 + a_5}{(\quad)}\right) L^*_{r,t-1} + \left(1 - \frac{a_2 c_3 + a_5}{(\quad)}\right) N_{r,t} - \frac{a_3}{(\quad)} E_{u,t} - \frac{a_4}{(\quad)} E_{r,t} \qquad (55)$$

$$- \frac{a_1 v_2 + a_2 v_3 + v_1}{(\quad)}$$

where $(\quad) = 1 - a_1 b_3 + a_2 c_3 + a_5$

Table 4. Reduced form estimation for case I

Endogenous Variables	Exogenous variables										
	C	$E_{u,t}$	$E_{r,t}$	$P_{u,t}$	$K_{u,t}$	$P_{r,t}$	$K_{r,t}$	$L^{*}_{u,t-1}$	$N_{u,t}$	$L^{*}_{r,t-1}$	$N_{r,t}$
$M_{ru,t}$	6157.09	+ 4,274	-210.35	+15.506	+0.534	-12.55	-3.865	-0.490	+.396	+.780	+1.448
	(2.897)**	(.230)	(2.700)**	(2.657)**	(2.108)**	(1.854)***	(1.530)***	(2.734)**	(2.395)**	(3.030)***	(3.964)*
	R^2 = .91	D.W. = 2.825	F(10,6) = 6.44								
$W_{u,t}$	987.32	-5.377	-2.568	+1.539	+0.232	-3.048	1.259	-0.0354	-0.0300	-0.0236	-0.0277
	(3.867)*	(2.300)**	(.382)	(2.761)**	(7.022)*	(3.494)**	(3.462)**	(1.726)***	(1.805)***	(0.902)	(0.716)
	R^2 = .99	D.W. = 3.311	F(10,7) = 240.57								
$W_{r,t}$	1526.7	-3.276	-18.576	+0.209	0.104	-2.733	+8.975	-7.520	-2.285	-0.123	-0.131
	(6.103)*	(1.507)***	(1.954)**	(0.301)	(3.517)*	(3.513)*	(0.314)	(3.552)*	(1.117)	(3.967)*	(3.005)**
	R^2 = .99	D.W. = 2.451	F(10,7) = 278.72								

Where the numbers in the parentheses are t ratios and
* = significant at the 1 percent level.
** = significant at the 5 percent level.
*** = significant at the 10 percent level.

Table 5. Impact multiplier for case I

	$E_{u,t}$	$E_{r,t}$	$P_{u,t}$	$K_{u,t}$	$P_{r,t}$	$K_{r,t}$	$L^*_{u,t-1}$	$N_{u,t}$	$L^*_{r,t-1}$	$N_{r,t}$
$M_{ru,t}$	+4.274	-210.35	+15.506	0.524	-12.55	-3.865	-0.490	-.396	+.780	+1.448
$W_{u,t}$	-5.377	-2.568	+1.539	-0.232	-3.048	1.259	-0.0354	-0.0300	-0.0236	-0.0277
$W_{r,t}$	-3.276	-18.576	+0.209	0.104	-2.733	8.975	-7.520	2.285	-0.123	-0.131

Table 6. Reduced form estimation for case II

$$M_{ru,t} = 7526.2 + 9.853\,P_{u,t-1} + 0.595K_{u,t-1} - 19.948\,P_{r,t-1} - 4.004K_{r,t-1} + 0.622\,E_{u,t-1} - 190.32\,E_{r,t-1}$$

(1.046) (.644) (.667) (.825) (.496) (1.142) (.965)

$$-2.254\,M_{ru,t-1} - 0.482\,L^{*}_{u,t-2} + 0.643\,N_{u,t-1} + 0.378\,L_{r,t-2} - 1.160\,L^{*}_{r,t-1} - 0.688\,N_{r,t-1}$$

(1.078) $N_{r,t}$ (.807) (.181) (.920 (.930) (.463)

$$W_{u,t} = 1337.4 + .415\,P_{u,t} + 2.662\,P_{u,t-1} + 0.0645\,K_{u,t} + 0.158\,K_{u,t-1} - 2.611\,P_{r,t-1} - 1.445\,K_{r,t-1}$$

(7.23)** (3.669)*** (21.08)** (.754) (1.808) (4.414)*** (12.59)**

$$-0.224\,M_{ru,t-1} - 15.53\,E_{u,t-1} - 37.08\,E_{r,t-1} - 0.679\,L^{*}_{u,t-1}$$

(11.111)** (2.81) (6.01)*** (6.647)**

$$+0.0223\,N_{u,t-1} - 0.108\,N_{u,t} - 0.1104\,L^{*}_{r,t-1} - 0.0991\,N_{r,t-1}$$

(.933) (3.201)*** (6.630)** (6.646)**

$$+0.0154\,N_{r,t}$$

(.933)

Table 6. Continued

$$W_{r,t} = 2631.5 - 1.1117 \underset{(27.584)^{**}}{} -4.604 \underset{(3.594)^{***}}{P_{r,t-1}} + 1.430 \underset{(15.136)^{**}}{K_{r,t}} - 1.627 \underset{(8.997)^{**}}{K_{r,t-1}} + 1.583 \underset{(9.558)^{**}}{P_{u,t-1}} + 1.403 \underset{(4.070)^{***}}{K_{u,t-1}}$$

$$-4.466 \underset{(12.878)^{**}}{E_{u,t-1}} -51.219 \underset{(4.910)^{***}}{E_{r,t-1}} +0.431 \underset{(21.236)^{**}}{M_{ru,t-1}} -0.156 \underset{(16.727)^{**}}{L^{*}_{u,t-2}} + 0.0689 \underset{(22.001)^{**}}{N_{u,t-1}}$$

$$+0.448 \underset{(14.561)^{**}}{L^{*}_{r,t-2}} -0.287 \underset{(6.453)^{**}}{L^{*}_{r,t-1}} -0.120 \underset{(18.680)^{**}}{N_{r,t-1}} +17.22 \underset{(12.968)^{**}}{N_{r,t}}$$

(.251)

where the numbers in the parenthesis are t ratios and
** = significant at the 5 percent level.
*** = significant at the 10 percent level.

Table 7. Impact multipliers for case II

Endogenous Variables	Predetermined Variables									
	$M_{ru,t-1}$	$P_{u,t}$	$P_{u,t-1}$	$K_{u,t}$	$K_{u,t-1}$	$P_{r,t}$	$P_{r,t-1}$	$K_{r,t}$	$K_{r,t-1}$	$E_{u,t-1}$
$M_{ru,t}$	2.254		+9.853		0.595		19.948		-4.004	-0.622
$W_{u,t}$	0.332	+3.240	-0.888	1.616	-0.443		-0.336		+0.289	-6.456
$W_{r,t}$	0.431		+1.583		1.403	1.117	-4.605	1.430	-1.627	-4.466

	Predetermined Variables								
	$E_{r,t-1}$	$L_{u,t-2}$	$L_{u,t-1}$	$N_{u,t-1}$	$N_{u,t}$	$L_{r,t-1}$	$L_{r,t-2}$	$N_{r,t}$	$N_{r,t-1}$
	-190.32	-0.482		+0.643		-1.160	+0.378	-0.148	-0.688
	-1.186	+0.372	-0.579	0.0287	-0.105	0.579	-0.372	0.883	-0.372
	-51.219	-0.156		+0.0689		-0.287	+0.448	-17.22	0.120

$$W_{u,t} = 218.46 + 0.551\ P_{u,t} + 0.0938\ K_{u,t} - 0.0136(L^{*}_{u,t-1} + M_{ru,t})$$

$$W_{r,t} = 393.07 - 0.422\ P_{r,t} + 0.7004\ K_{r,t} - 0.0223(L^{*}_{r,t-1} + N_{r,t} + M_{ru,t}) \qquad (54)$$

where $\frac{\partial W_{u,t}}{\partial N_{u,t}} = -0.0136$, $\frac{\partial W_{r,t}}{\partial N_{r,t}} = -0.0223$, $\frac{\partial W_{u,t}}{\partial M_{ru,t}} = -0.0136$

$\frac{\partial W_{r,t}}{\partial M_{ru,t}} = 0.0136$. It is hypothesized that natural increase in the rural labor force will lower the wage rate in both rural and urban areas so that rapid natural increase in rural areas may induce increased rural-urban migration. The empirical results shown in Table 4 conform this expectation.

Consider now the impacts of economic variables on migration. Both current and lagged values of these variables give expected signs as shown in Tables 5 and 7. Thus, the discussion will rely mainly on Table 5. Economic activities -- the prices of urban and rural goods and the magnitude of capital stock are shown to have a direct effect on migration as noted below.

$$\frac{\partial M_{ru,t}}{\partial P_{u,t}} = 15.506, \qquad \frac{\partial M_{ru,t}}{\partial K_{u,t}} = .534$$

$$\frac{\partial M_{ru,t}}{\partial P_{r,t}} = -12.550 \qquad \frac{\partial M_{ru,t}}{\partial K_{r,t}} = -3.866$$

The hypothesis indicates:

$$\frac{\partial M_{ru,t}}{\partial P_{u,t}}, \qquad \frac{\partial M_{ru,t}}{\partial K_{u,t}} > 0$$

$$\frac{\partial M_{ru,t}}{\partial P_{r,t}}, \qquad \frac{\partial M_{ru,t}}{\partial K_{r,t}} < 0.$$

Therefore, the coefficients have the expected signs and were significantly different from zero at the conventional test levels.

The empirical results imply that as the prices of urban goods increase, migration increases, and vice versa; net out-migration increases when the prices of rural goods fall. As economic theory predicts, changes in the prices of final goods cause reallocation of human resources. Migration is closely related with this resource reallocation. Thus, it is clear that the relative prices of rural and urban goods can be utilized as a very powerful policy variable by government. In fact, many governments in developing countires are now using these prices as a policy variable, but not for the purpose of influencing migration. They commonly try to keep agricultural prices at low levels by increasing food imports since world agricultural prices are lower than domestic agricultural prices.

The low agricultural price policy which provides a net flow of human and other resources out of agriculture has its incidence on agricultural production and nonagricultural production. The low agricultural price may not encourage to improve technology in agricultural production. Thus, agricultural production slows down while growth of the nonagricultural sector may be facilitating a net increase in the demand for food causing an upward pressure on food prices and food import will continue to increase. If this process continues, growth of the nonagricultural sector may also be halted by scarcity of foreign exchange and the shortage of demand for nonagricultural goods. Thus, the low relative prices of agricultural goods could result in over concentration of population in the urban sector and relative scarcity of agricultural goods. Though the

relative prices of agricultural goods in Korea fluctuate widely in response to varying crop production levels they were below the prices of urban goods until 1970. The lower relative prices of agricultural goods in Korea may be a major contributing factor of urban concentration. The relationship between migration and the prices of rural goods established in this study supports this presumption. Therefore, if governments in developing countries wish to use agricultural prices as a policy variable to effectuate population redistribution, the full incidence of this policy on resource distribution should be examined carefully.

The coefficients of the capital variables were hypothesized to have a positive sign in urban areas and a negative sign in rural areas. The empirical results do not contradict this hypothesis. This implies that migration will increase as urban capital increases and migration will decrease as rural capital increases. The magnitude of the rural capital multiplier is larger than that of the urban sector. The increase in rural capital may reduce rural-urban migration, but the economic efficiency of investment in rural areas is a different matter. This question is beyond the scope of the present study. It is evident that capital investment can be an important explanatory variable in population redistribution.

Capital investment and product prices play significant roles in wage determination. The magnitude of the multipliers in Table 4 indicate that these economic activities are very important in rural and urban wage determination.

$$\frac{\partial W_{u,t}}{\partial K_{u,t}} = 0.232 \qquad \frac{\partial W_{u,t}}{\partial K_{r,t}} = 1.259$$

$$\frac{\partial W_{r,t}}{\partial K_{u,t}} = 0.104 \qquad \frac{\partial W_{r,t}}{\partial K_{r,t}} = 8.975$$

Capital investments encourage an increase in real wages for both sectors. Capital investment in urban areas increases not only the urban wage rate but also encourages an increase in real rural wages. Capital investment in urban areas will induce a leftward shift in the rural labor supply curve through rural-urban migration. Thus, capital investment in urban areas benefits the urban laborers as well as the rural laborers.

$$\frac{\partial W_{u,t}}{\partial P_{u,t}} = 1.539 \qquad \frac{\partial W_{u,t}}{\partial P_{r,t}} = -3.048$$

$$\frac{\partial W_{r,t}}{\partial P_{u,t}} = 0.209 \qquad \frac{\partial W_{r,t}}{\partial P_{r,t}} = -2.733$$

From the multipliers, it is noted that as prices of urban goods increase, urban wage rates rose and as prices of rural goods increase, urban wage rates decrease. Prices of rural goods are seen to be inversely related to rural wages and the prices of urban goods have a positive relationship with rural wages. The rural and urban labor forces, in general, pull down the real wage rates in both sectors. The signs of the labor force variables may differ from this observation, however, depending on the economic conditions of the country. For instance, if the country is relatively short of labor, the signs may be positive.

The impact multipliers in Table 7 are somewhat different from the multipliers estimated for the reduced form in Case I in the sense that current migration depends on the previous year's migration. This lagged value of migration adds interesting information to the

analysis. As indicated earlier, this variable has been regarded as the proxy variable for information on destination areas. The sign of this variable was expected to be positive. The empirical results show the expected sign. However, this study was not designed to answer this question and discussion will not be extended in great detail. The impact of lagged migration on the wage rates of both sectors was as follows:

$$\frac{\partial W_{u,t}}{\partial M_{ru,t-1}} = -0.224 \qquad \frac{\partial W_{r,t}}{\partial M_{ru,t-1}} = 0.431$$

These multipliers indicate that migration narrows rural-urban wage differential. Many development economists argue that $\frac{W_{r,t}}{M_{ru,t-1}}$ is equal to zero or near zero in the densely populated developing countries. This means that the demand curve for rural labor is thought to be infinitely elastic. But the results obtained from the Korean economy do not support such an agrument.

Single equation model

Because of simultaneities between migration ($M_{ru,t}$) and wage rates ($W_{u,t}$, $W_{r,t}$), the simultaneous equations model was developed and it has been evaluated in the previous section. In the single equation model independence of $W_{u,t}$ and $W_{r,t}$ on v_1 in equation (38) was assumed. The ordinary least squares estimator will be consistent under this assumption. In order to compare the results of ordinary least squares (OLS) with the results of two stage least squares (2SLS), these two estimators are presented in Table 8. A 2SLS

Table 8. Comparison of OLS and 2SLS estimates

		C	$W_{u,t}$	$W_{u,t-1}$	$W_{u,t}-W_{u,t-1}$	$W_{r,t}$	$W_{r,t-1}$	$W_{r,t}-W_{r,t-1}$	$E_{u,t}$
Case I	OLS	3433.2 (4.057)*	3.471 (2.543)**			-6.261 (3.453)*			-9.562 (0.498)
	2SLS	3638.41 (4.147)*	4.147 (2.894)**			-7.167 (3.759)			-8.678 (0.441)
Case II	OLS	1970.0 (5.988)*		-0.197 (.384)		-1.899 (3.370)*			
	2SLS	1946.3 (5.541)*		-0.438 (1.12)		-1.713 (3.341)			
Case III	OLS	2077.7 (2.343)**	-1.455 (1.711)***		-0.171 (0.245)	-0.692 (0.530)		1.059 (0.997)	-70.122 (2.372)**
	2SLS	3901.3 (2.607)**	3.798 (1.420)***		-1.778 (1.885)**	-7.243 (1.988)**		1.607 (1.419)***	-56.539 (1.613)***

Table 8. Continued

$E_{u,t-1}$	$E_{u,y}-E_{u,t-1}$	$E_{r,t}$	$E_{r,t-1}$	$E_{r,t}-E_{r,t-1}$	$L^{*}_{r,t}$	R^2	D.W.	F
		-19.788 (0.497)			-0.387 (3.973)*	.60	2.407	3.392
		-23.504 (0.697)			-0.413 (4.073)*	.59	2.396	3.189
57.658 (3.629)*			-7.184 (0.280)		-0.0697 (1.674)***	.77	2.223	7.473
-64.205 (4.283)*			-14.255 (.593)		-0.0500 (1.106)	.76	2.137	7.675
	67.013 (3.644)*	-4.723 (8.193)*		0.577 (1.428)***	-0.0416 (0.417)	.80	2.365	3.618
	18.451 (0.604)	46.353 (0.628)		48.993 (0.923)	0.363 (1.683)	.72	2.208	2.381

where the numbers in parentheses are t ratios and
* = significant at 1 percent level.
** = significant at 5 percent level.
*** = significant at 10 percent level.

estimate was made under the assumption that the independence of $W_{u,t}$ and $W_{r,t}$ on v_1 was violated in the migration function.

Since economic interpretation for the migration function was given in the previous section, this section will discuss only the statistical significance of the model. First, R^2 was only slightly higher for the OLS estimates than for the 2SLS estimates. The t[48] and F statistics were also so close that one cannot differentiate which is better. However, the simultaneous equations model provides more information for the functioning of the economic system. Economic assumptions can be made more realistic by increasing the size of the model--but in doing this mathematical complexity also may increase beyond practical limitations. Therefore, it was necessary to make the trade-off between economic realism and mathematical manageability. It was for this reason that prices of products and unemployment which should be endogenous variables were treated as exogenous variables in the simultaneous model.

Since the models in this study involve a rather large set of variables and were tested by three different cases, a summary of their discussions is presented in Table 9. The classifications of strongly agree; disagree; strongly disagree were made on the basis of the criteria defined at the beginning of present chapter and at the bottom of Table 9.

The set of explanatory variables, $W_{r,t-1}$, $E_{u,t}$, $E_{u,t-1}$, $K_{u,t}$, and $K_{r,t}$ from Table 9 strongly support the hypotheses of the structural

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[48]As mentioned earlier t-statistics may not be appropriate for the simultaneous equations model. But it may be meaningful to compare the results of OLS and 2SLS estimators.

Table 9. A comparison of the degree of conformity of statistical results with hypotheses based on the economic model

Dependent variables	Strongly[a] agree	Agree[b]	Disagree[c]	Strongly[d] disagree
1. Structural form				
$M_{ru,t}$	$W_{r,t-1}$	$W_{u,t}$	$W_{u,t-1}$	$L^*_{r,t}$
	$E_{u,t}$	$W_{r,t}$	$W_{u,t}-W_{u,t-1}$	
	$E_{u,t}$	$E_{t,t-1}$	$Wr,t-W_{r,t-1}$	
			$E_{r,t}-E_{u,t-1}$	
			$E_{r,t}-E_{r,t-1}$	
			$E_{r,t}$	
$W_{u,t}$	$K_{u,t}$	$P_{u,t}$ $L^*_{u,t}$		
$W_{r,t}$	$K_{r,t}$	$L^*_{r,t}$	$P_{r,t}$	
2. Reduced form				
$M_{ru.t}$	$P_{u,t}$	$E_{u,t-1}$	$N_{u,t}$	$E_{r,t}$
$W_{u,t}$	$P_{r,t}$	$E_{r,t-1}$	$N_{u,t-1}$	
$W_{r,t}$	$K_{u,t}$	$M_{ru,t-1}$	$K_{r,t-1}$	
	$K_{r,t}$	$L_{r,t-1}$	$E_{u,t}$	
	$P_{u,t-1}$	$L_{r,t-1}$		
	$K_{u,t-1}$	$N_{r,t}$		
	$L_{u,t-1}$	$P_{r,t-1}$		
	$N_{r,t-1}$			

a, b, c, and d are classified by the following criteria:

Strongly agree: Expected sign and significantly different from zero at the conventional test levels ($0.001 < \alpha < 0.01$).

Agree: Expected sign but not significantly different from zero at the conventional test levels.

Disagree: Unexpected sign but not significantly different from zero at the conventional test levels.

Strongly disagree: Unexpected sign but significantly different from zero at the conventional test levels.

forms. Another set of explanatory variables, $W_{u,t}$, $W_{r,t}$, $E_{r,t-1}$, $P_{u,t}$, $L_{u,t}$ and $L_{r,t}$ in general agree with the hypotheses. The economic opportunity differential variables ($W_{u,t} - W_{u,t-1}$, $W_{r,t} - W_{r,t-1}$, $E_{u,t-}$ $E_{u,t-1}$, and $E_{r,t} - E_{r,t-1}$) do not support the hypotheses. The coefficients of the variables, $P_{r,t}$, $E_{r,t}$, and $L_{r,t}$ appear not to support the hypotheses, but each case can be rationalized. The estimated coefficients generally support the hypotheses on rural-urban migration although further improvement in data and refinement of behavioral hypotheses appear to be warranted based on results obtained here.

This study is of special interest in examining the effects of economic variables such as the relative price of rural and urban goods and the magnitudes of capital stock in rural and urban areas on rural-urban migration. These variables were examined in the reduced forms obtained from the simultaneous equations system. As shown in Table 9, most coefficients conform to the hypotheses. The variables $P_{u,t}$, $P_{r,t}$, $K_{u,t}$ and $K_{r,t}$ strongly support the hypotheses. The empirical results imply that migration increased as the prices of rural goods fall. Migration increased as urban capital increased and migration decreased as rural capital increased. This provides strong evidence that the relative prices of rural and urban goods and the investment of capital in both rural and urban areas can be utilized as a powerful policy variable by government. The natural increase of labor force in rural areas also agrees with the hypothesis that rural-urban migration increases as the natural increase in rural areas increases and vice versa.

Based on this analysis, it seems clear that changing relative economic opportunities, changing output prices, and capital investments

between the rural and urban areas are the predominant factors providing impetus for redistribution of human resources. Thus, government is faced with alternative policies for the reduction of rural-urban migration. For instance, the government may give wage subsidies to the rural employment sector, may increase social investment via large-scale public investment or subsidization of a core group of industries in order to raise the productivity of private investment, or may allow a rise in agricultural prices. Each of these policies would tend to reduce the flow of resources from the agricultural sector to the non-agricultural sector. Problems of this sort may not facilitate efficient resource allocation and the optimal growth of the national economy. Therefore, the efficiency aspects of stimulating a resource flow should be examined carefully before these policy variables are implemented for achieving population redistribution.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The major objectives of this study were to identify and test selected economic determinants of rural-urban migration and to examine the impact of migration on rural and urban labor markets.

The economic opportunity hypothesis in migration theory was the major hypothesis tested and was generally well supported by the empirical evidence. The major explanatory variable in the economic opportunity hypothesis is the wage differential which measures the discrepancy in labor factor payments between sectors. Shifts in supply and demand schedules of labor will cause discrepancies in sector wage rates. Therefore, shifting of labor supply and demand schedules will be the determinant of labor reallocation between sectors and between rural and urban areas. The shifting factors are economic activities such as the prices of rural and urban goods, capital investments in both areas, and the labor forces in both areas.

The price of urban goods would be relatively high in the early stages of industrialization since urban goods are scarce and people prefer to consume more urban goods as income increases. The higher price of urban goods will cause the demand schedule for urban labor to shift to the right. Economic development in developing countries is synonymous with industrialization so capital investment is concentrated in urban areas to produce more urban goods. Heavy investment in urban areas will also shift the demand schedule for labor. These shifts of the demand schedule will result

in a reallocation of labor between rural and urban areas. Thus, it was hypothesized that the prices of rural and urban goods and the change in capital stock are the major determinants of rural-urban migration.

Traditional migration models mainly concentrate on the wage differential between regions. However, because of increasing concern with rapid urbanization and capital formation issues in developing countries, the questions of population redistribution between rural and urban areas are raised. In order to answer these policy questions and to examine the effectiveness of the policy variables on migration, the migration model was specified as a system of equations.

The migration function, examined for three cases, generally supports the economic opportunity hypothesis in Korea as much as in other countries or other regional studies. The partial derivatives of the variables were expected to have the following signs:

$$\frac{\partial M_{ru,t}}{\partial W_{u,t}} > 0, \qquad \frac{\partial M_{ru,t}}{\partial W_{r,t}} < 0, \qquad \frac{\partial M_{ru,t}}{\partial E_{u,t}} < 0$$

$$\frac{\partial M_{ru,t}}{\partial E_{r,t}} > 0, \qquad \frac{\partial M_{ru,t}}{\partial L^{*}_{r,t}} > 0.$$

Empirical results of the study showed the expected signs except for rural labor and unemployment. The urban unemployment rate is much higher than the rural unemployment rate. Todaro developed a model which rationalizes the behavior of the rural-urban migration in developing countries with higher urban unemployment. He indicated that a migrant's expected income stream in the modern industrial sector is high enough to compensate for the period of unemployment in the urban area.

As long as the rural-urban real income differential continues to rise, the job opportunities in the rural areas may not be an important decision variable for the prospective migrants. Thus, rural-urban migration may continue to increase even as job opportunities are getting better in the rural areas. As discussed in the previous chapter, rural unemployment statistics and the explanatory power of the unemployment variable has been questioned.

The economic theory of factor payments predicts migration to flow from lower wage rural areas to higher wage urban areas. In agreement with this, the estimated coefficient of the urban wage rate had a positive sign and that of the rural wage rate showed a negative sign. The labor stock variable can be expected to have either a positive or negative sign. Traditionally, the labor stock variable is representative of gravity and migration is expected to be larger as the rural labor stock increases, but a negative sign may also be expected due to the process of labor market adjustment. If migration flows from rural to urban areas continuously, the cumulative labor stock in rural areas decreases as out-migration continues. The present study showed this inverse relationship between migration and labor stock.

Urban and rural wage functions showed consistent relationships in all cases. The partial derivatives of the variables were expected to have the following signs:

$$\frac{\partial W_{u,t}}{\partial P_{u,t}} \gtrless 0, \qquad \frac{\partial W_{u,t}}{\partial K_{u,t}} > 0, \qquad \frac{\partial W_{u,t}}{\partial L^{*}_{u,t}} < 0,$$

$$\frac{\partial W_{r,t}}{\partial P_{r,t}} \gtrless 0, \qquad \frac{\partial W_{r,t}}{\partial K_{r,t}} > 0, \qquad \frac{\partial W_{r,t}}{\partial L^{*}_{r,t}} < 0.$$

It was hypothesized that the coefficients of the price variables may be positive, negative, or neutral in sign depending on the labor market adjustment. The empirical results showed a positive sign on the urban price variable and a negative sign on the rural price variable. The relative price of the urban goods were higher than the prices of rural goods during the observed period. The demand curve for urban labor might shift rightward faster than the supply curve and the rural labor supply could shift leftward faster than the demand curve for rural labor. Thus, it is possible that the urban wage rate rises as the prices of urban goods increase and the rural wage rate also rises when the relative prices of rural goods fall relative to urban prices.

The capital stock variables had positive signs in both sectors as expected. This implies that capital investment had a positive effect on both rural and urban labor markets.

The negative signs of the labor stock variables in both rural and urban areas indicate inverse relationships between the wage rates and labor stocks. Since urban labor stocks are increasing continuously and rural labor stocks are decreasing via migration, the inverse relationships between wage rates and labor stocks imply that the urban wage rate is decreasing as urban labor increases and the rural wage rate is increasing as rural labor decreases.

The structural form shows the interaction among endogenous variables within the system. The reduced form indicates the partial effects of predetermined variables on endogenous variables. Thus, the reduced form has been utilized to analyze the impacts of capital investment and price variables on migration and to examine the impacts of migration on both rural and urban labor markets. Each coefficient of the reduced form

implies the balanced impact of a unit change in one of the predetermined variables on one of the endogenous variables. In other words, the full interaction in the system due to the change of the predetermined variables is not explained; a coefficient only reflects the net effect of a unit change in an exogenous variable on an endogenous variable.

The coefficients of the capital and price variables were significantly different from zero in the migration function at the conventional test levels and they have expected signs, as noted below:

$$\frac{\partial M_{ru,t}}{\partial P_{u,t}} > 0, \qquad \frac{\partial M_{ru,t}}{\partial K_{u,t}} > 0,$$

$$\frac{\partial M_{ru,t}}{\partial P_{r,t}} < 0, \qquad \frac{\partial M_{ru,t}}{\partial K_{r,t}} < 0.$$

As shown in Table 5, the empirical results generally conformed to the expectations based on economic and migration theories. The empirical results may imply that rural-urban migration will increase as the prices of urban goods and the urban capital stock increase. Rural-urban migration will be reduced when the relative prices of rural goods rise and capital investment in rural areas increases.

The relative magnitude of the impact multipliers can be shown as follows:

$$\left| \frac{\partial M_{ru,t}}{\partial P_{u,t}} \right| > \left| \frac{\partial M_{ru,t}}{\partial P_{r,t}} \right|$$

$$\left| \frac{\partial M_{ru,t}}{\partial K_{u,t}} \right| < \left| \frac{\partial M_{ru,t}}{\partial K_{r,t}} \right|$$

These inequalities imply that the prices of urban goods have more explanatory power than those of rural goods, and rural capital exercises more explanatory power than urban capital.

The impacts of relative prices and capital variables on the wage rates are very significant. The capital variables are positively related to both rural and urban wage rates. The rural prive variable shows an inverse relationship to both rural and urban wages. These results may imply that the prices of urban goods are a strong pulling factor and the prices of rural goods are a pushing factor of rural-urban migration in Korea.

What is the impact of migration on rural and urban labor markets? This question has been raised by many social scientists on various occasions. Empirical results indicate net out-migration from the rural sector is positively related to the rural wage rate and net in-migration in urban areas is negatively related to the urban wage rate as shown in Table 8.

$$\frac{\partial W_{u,t}}{\partial M_{ru,t-1}} = -0.224 \qquad \frac{\partial W_{r,t}}{\partial M_{ru,t-1}} = 0.431$$

$$\left| \frac{\partial W_{u,t}}{\partial M_{tu,t-1}} \right| < \left| \frac{\partial W_{r,t}}{\partial M_{ru,t-1}} \right|$$

The comparison of the two multipliers implies that net out-migration of one person has more influence on the rural wage rate than of one person net in-migration has on the urban wage rate. The urban wage rate will be reduced and the rural wage will be increased due to rural-urban migration. If other things such as shifting factors of demand and supply

of labor remain constant, the discrepancy of wage rates between rural and urban areas will disappear as rural-urban migration occurs. However, the shifting factors which may be called policy variables are changing over time. Thus, it may take a long time to reach equilibrium or the system may not reach equilibrium if the policy variables change continuously in disequilibrating directions.

Conclusions

From the above summary of the study, the conclusion can be drawn that the empirical results are generally consistent with economic theory and provide no basis to refute the hypotheses incorporated into the model. The prices of rural and urban goods and capital investments in both sectors were found to be major economic determinants of rural-urban migration. The changes in relative prices of rural and urban goods were found to exert a significant impact on human resource redistribution. A decrease in prices of rural goods may induce an increase in out-migration and an increase in prices of urban goods may be a pulling factor of rural-urban migration so that rural-urban migration will increase. Thus, the net out-migration may be reduced when agricultural prices increase.

According to the empirical results, an increase in capital in rural areas will reduce net out-migration from the rural areas and an increase in urban investment will increase net in-migration into urban areas. Investment was found to be the most significant variable in determining wage rates as well as migration. However, in the formulation of economic policy, the economic efficiency aspects of capital investment should be examined carefully along with the population redistribution.

The urban unemployment coefficient and those of the rural and urban wage rates were found to be highly significant in most cases; they also have the predicted signs. The rural unemployment and labor force variables show somewhat contradictory results. However, the economic opportunity hypothesis for the migration function was generally supported by Korean data.

The study shows that labor stocks are inversely related to wage rates in both rural and urban areas. This implies that the demand curve of labor in rural areas is not infinitely elastic and continuous out-migration from rural areas may reduce the production of rural goods unless labor-saving/output increasing technical change is introduced. This indicates that the classical economists' arguments may not be applicable to the Korean economy during the time period studied. The present study was not directed to the specific question of labor productivity. Observed time periods were relatively long so that this study is specific enough to address the question during the period it covers. Therefore, before the efficacy of further out-migration or the policy of reducing out-migration can be evaluated, these economic circumstances should be considered.

Subsequently, since labor migration is positively related with the rural wage and negatively related with the urban wage rate, labor migration narrows down the discrepancy of wage rates between rural and urban areas, and could be expected to eliminate the wage differential if other things remain constant.

Over-urbanization is often times a matter of value judgment rather than rigorous economic analysis. Monitoring the policy variables to redistribute the population requires a careful analysis of the economy

because it may lead to the misallocation of resources. Suppose the government keeps agricultural prices down. This may induce out-migration and reduce agricultural production. As D. Gale Johnson[49] has shown, the present food shortages in the developing countries may be caused by keeping agricultural prices low.

The terms of trade in Korea have fluctuated widely, but they became favorable to agricultural products after 1971 as shown in Table 1 and the urban concentration has been reduced since 1971. The urban concentration of population was increasing while the terms of trade were unfavorable to agricultural products. Therefore, the urban concentration of population may be attributable, in part, to the unfavorable terms of trade.

The present sutdy concentrated on the economic determinants of rural-urban labor migration at the macro level. It has been restricted by many factors, especially the data which were very aggregate and not complete. Some of the data were negative so that a log transformation of the data was impossible. It would have been a better concept and mathematical formulation if a log transformation had been possible. Mathematical specification of the migration function requires more clarification from many perspectives. However, despite these weaknesses, the present study was able to examine within the context of a simultaneous equation system several economic variables which were expected to affect population redistribution and examine some of the impacts of rural-urban labor migration on the economy.

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[49] D. Gale Johnson, World Agriculture in Disarray (New York: St. Martin's Press, 1973).

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APPENDICIES

Appendix A

Capital stock is increased by capital formation. In other words, capital formation is the process of adding to a given stock of capital.

$$\frac{dK}{dt} = I(t)$$

$$K(t) - \int_0^t I(t)dt = \int \frac{dK}{dt}\, dt = \int I(t)dt$$

We may express the amount of capital accumulation during the time interval (0,t), for any investment rate I(t), by the definite integral,

$$\int_0^t I(t)\, dt = K(t) \Big]_0^t = K(t) - K(0)$$

$$K(t) = K(0) + \int_0^t I(t)dt$$

where K(t) is capital stock at time t, K(0) is initial capital stock, and $\int_0^t I(t)dt$ represents capital formation and change in capital stock.

In this study $\int_0^t I(t)dt$ was employed for the estimation of the parameters since K(0) was not available. However, the estimation of the parameters was not biased due to the missing information K(0) except for the intercept terms. Since the model in this study is relatively large, arithmetic manipulation is complicated. Therefore, a very simple example of simultaneous equation systems will be used for explanatory purposes:

$$C_t = b_o + b_1 Y_t + u_t$$

$$Y_t = C_t + Z_t$$

where C_t = consumption expenditure

Y_t = income

Z_t = nonconsumption expenditure

u_t = a stochastic disturbance term

t = time period

Since capital stock in the study is an exogenous variable, only Z which is an exogenous variable in the present example, will be considered. Suppose $Z_t = Z(t) + K_0$ where K_0 is constant.

The first step:

$$Y_t = \P_1 + \P Z_{2t} + e$$

$$\hat{\P}_2 = \frac{\Sigma(Z_t - \bar{Z}_t)(Y_t - \bar{Y}_t)}{\Sigma(Z_t - \bar{Z}_t)^2}$$

$$\hat{\P}_1 = \bar{Y}_t - \hat{\P}_2 \bar{Z}_t$$

In the estimating parameter $\hat{\P}_2$, the deviation from the arithmetic mean will be important.

$$\bar{Z}_t = \bar{Z}(t) + K_0$$

$$Z_t - \bar{Z}(t) = \Sigma Z(t) + K_0 - \bar{Z}(t) - K_0$$

$$= \Sigma Z(t) - \bar{Z}(t)$$

Thus, K_0 will have no influence in estimating $\hat{\P}_2$. However, it will affect $\hat{\P}_1$.

$$\hat{\P}_1 = \bar{Y}_t - \P_2 \bar{Z}_t$$

Since $\bar{Z}_t > \bar{Z}(t)$, $\hat{\P}_1$ will be overestimated or underestimated depending on the sign of $\P_2$.

The second step:

$$C = b_o + b_1(Y) + (u + b_o e)$$

$$\hat{b}_1 = \frac{\Sigma(C - \bar{C})(\hat{Y} - \bar{\hat{Y}})}{\Sigma(\hat{Y} - \bar{\hat{Y}})^2}$$

$$\hat{b}_o = \bar{C} - \hat{b}_1 \bar{\hat{Y}}$$

As shown in the first step $Y - \bar{\hat{Y}}$ will depend only $\hat{\pi}_2 \bar{Z}(t)$. Since $\hat{\pi}_1$, and $\hat{\pi}_2 \cdot K_0$ are constants, they will not influence the deviation from the arithmetic mean.

$$\hat{Y}_t = \pi_1 + \pi_2 Z_t$$

$$= \pi_1 + \pi_2(\Sigma Z(t) + K_0)$$

$$= \hat{\pi}_1 + \hat{\pi} \cdot K_0 + \hat{\pi}_2 \Sigma Z(t) = \pi_1 - \pi_2 \cdot K_0 - \pi_2 \cdot \bar{Z}(t)$$

$$\hat{Y} - \bar{\hat{Y}} = \hat{\pi}_1 + \hat{\pi}_2 \cdot K_0 + \hat{\pi}_2 \Sigma Z(t) - \pi_1 - \pi_2 \cdot K_0 \pi_2 \cdot \bar{Z}(t)$$

$$= \hat{\pi}_2(\Sigma Z(t) - \bar{Z}(t))$$

Hence $$(C - \bar{C})(Y - \bar{\hat{Y}}) = \pi_2 \Sigma(C - \bar{C})(\Sigma Z(t) - \bar{Z}(t))$$

$$(Y - \bar{\hat{Y}})^2 = \hat{\pi}_2^2 (\Sigma Z(t) - \bar{Z}(t))^2$$

$$b_1 = \frac{\Sigma(C - \bar{C})(\Sigma Z(t) - \bar{Z}(t))}{\Sigma(Y - \bar{Y})(\Sigma Z(t) - \bar{Z}(t))}$$

$$b_o = \bar{C} - b_1 \bar{\hat{Y}}$$

Consequently, b_o will be under- or over-estimated depending on the sign of b_1. Thus, the intercept terms in the text (a_o, b_o, and c_o) may be biased, but other parameters will not be influenced by the missing K_0.

Appendix B

Price indices and nominal wage rates

	All Cities CPI[a]	Rural CPI[b]	Wholesale CPI[c]	Urban Nominal Wage Rates (Won)[d]	Rural Nominal Wage Rates (Won)[e]
1955	16.06	14.98	19.24	74.00	42.19
1956	22.15	20.35	31.09	78.00	62.87
1957	28.43	26.88	29.42	80.00	69.17
1958	27.25	24.66	27.59	87.00	67.20
1959	28.86	26.13	28.33	92.00	68.00
1960	31.96	28.81	31.00	101.96	71.17
1961	34.99	31.40	35.10	114.11	75.71
1962	37.95	34.30	38.40	120.08	76.56
1963	45.80	38.30	46.30	134.55	115.28
1964	52.19	49.50	62.30	162.75	154.71
1965	56.00	55.10	68.50	187.95	191.72
1966	62.50	61.80	74.60	216.60	222.16
1967	69.10	69.60	79.40	267.46	268.64
1968	76.60	80.30	85.80	325.85	332.15
1969	86.20	87.60	91.60	443.70	404.46
1970	100.00	100.00	100.00	571.02	500.49
1971	113.50	112.30	108.60	683.03	602.18
1972	126.80	125.30	123.80	770.22	695.46

Sources:

a was obtained from the Korea Statistical Year Book(Bureau of Statistics of Economic Planning Board, 1965 - 1973). Figures prior to 1965 are not available from the above source. They are estimated on the basis of the Seoul Consumer Price Index which is listed for the entire period.

b was obtained from the Korea Statistical Year Book(Bureau of Statistics of Economic Planning Board, 1959 - 1973). 1955 through 1958 data are estimated on the basis of the wholesale price index.

c, d, e were obtained from the Korea Statistical Year Book from 1955 to 1973.

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